

Case Report

Food poisoning: A case study in Vietnam

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ARTICLE INFO

Keywords:

Case study

Food poisoning

Unhealthy foods

Vietnam

ABSTRACT

Background and aim: In Vietnam, some foods may lead to poisoning for consumers. This study was conducted to describe poisoning cases from unhealthy food in Vietnam from March 2020 to August 2022.

Method: Seven popular Vietnamese online newspapers were chosen through the purposive sampling method. The keyword “poisoning” was used to data searching.

Results: We recorded 184 articles that report food poisoning through data searching. In those 184 articles, there were 3711 people with food poisoning, equivalent to 3711 food poisoning cases. Some types of food had been reported poisoning such as mushrooms, toads, alcohol, insects e.g. Vietnam’s two big cities and economic hubs, had recorded the most incidents of food poisonings. There was no specific rule on the number of food poisoning cases during the study time. The greatest number of food poisoning in July 2020 (566 cases), followed by September 2020 (445 cases), and June 2020 (336 cases).

Conclusion: The number of the food poisoning case in Vietnam seems to be depended on each region and time of year. Our research is a useful reference for studies with a broader scale and a richer participant in the future.

1. Introduction

Food poisoning is a severe illness that occurs when consuming spoiled or unhygienic food. This happens when the patient ingests food containing harmful bacteria or toxins [1]. The ingestion of these contaminated foods is due to the ignorance of consumers [2]. The knowledge of consumers about food hygiene is very important. There is a great number of consumers who lack understanding about how to preserve, how to eat food in a hygienic way and what foods are unhealthy. It will be very easy for them to fall victim to food poisoning. According to the World Health Organization (WHO) [3], each year, 1.5 billion cases of diarrhea in children are caused by tainted food, leading to over 3 million premature deaths [4]. Additionally, according to the Centers for Disease Control and Prevention (CDC), 325,000 hospitalizations and 76 million illnesses due to foodborne infections are expected to occur yearly among the 290 million people who live in the United States [5]. Both developing and developed countries are experiencing an increase in food transmission. Bacteria, parasites, viruses, or infectious microorganisms are mainly causes of food poisoning. Besides, food allergy can also be a part of food poisoning. According to reports in Asia

and sub-Saharan Africa, about 200,000 Nigerians died from poisoning food, of which about 4–8% were allergic to the food they eat [2]. In addition, the cause of food poisoning can come from consumers themselves when they do not keep their hands and nails clean, which leads to food being contaminated with bacteria [6].

In Vietnam, many foods lead to poisoning [7]. First, blood pudding is one of the most popular dishes among Vietnamese people from past to present. The first diseases that can be easily acquired by eating blood pudding are parasitic infections like tapeworms, brainworms, and helminths. There are parasites or flukes in plants and raw meat. When animals eat them, the animals become infected with parasites and flukes and so as humans who eat animal blood soup. The eggs of the parasites and flukes enter the body and develop into larvae. The bacteria then penetrate the gastrointestinal mucosa and they colonize all organ systems. The larvae of the fluke will go to the brain and nest, causing headaches, nausea, and more dangerously, epilepsy. In addition, eating blood soup can lead to acute diarrhea or meningitis, multi-organ failure, etc [8]. Second, in Vietnam, fish salad is also very popular. There are many flukes in uncooked meat of fish, causing several digestive disorders, rash, increased white blood cells, cholangitis and cirrhosis [9].

Abbreviations: WHO, The World Health Organization; CDC, The Centers for Disease Control and Prevention.

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<https://doi.org/10.1016/j.csee.2022.100295>

Received 2 December 2022; Received in revised form 30 December 2022; Accepted 31 December 2022

Available online 11 January 2023

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Moreover, food poisoning can be caused by eating meat from wild animals such as snakes, frogs, toads, bats, mice or insects such as crickets, ticks [10]. These animals carry many pathogens of infectious diseases, especially mice and bats, which possibly leads to gastrointestinal infections and blood infections. Frogs, toads, and snakes contain many toxins in some of their parts, and when eaten; they will be susceptible to acute poisoning. Digoxin, tryptamines, and tetrodotoxin are some of the potent toxins on their backs or behind their eyes. These can result in a variety of symptoms including irregular heartbeat, dizziness, cardiac arrest, and paralysis. Salmonella bacteria are also known to be spread by frogs and toads [11]. It is impossible not to mention the status of alcohol poisoning in Vietnam so far. According to Food Safety Department, the cause of alcohol poisoning is alcohol abuse and unknown alcohol origins. Drinking industrial alcohol with methanol content being more than 0.1% can lead to blindness or more even death. Plants or animals with unknown toxicity soaked in alcohol can also lead to serious poisoning cases that can be fatal or critical [12].

From past to present, the eating habits of Vietnamese people have been very difficult to break because of consumers' preferences, habits, and limited knowledge of food poisoning [13]. We need an inventory of food poisoning cases and a description of the food poisoning situation to raise the awareness of Vietnamese consumers of this matter. Therefore, this study is carried out to synthesize and describe food poisoning cases in Vietnam from 2020 to 2022. In this case study, we aim to warn of a risk to public health and to contribute to human development.

2. Methods

2.1. Study design

We conducted the case study to describe poisoning cases from unhealthy food in Vietnam from March 2020 to August 2022.

2.2. Data collection

We collected data on food poisoning cases through seven popular Vietnamese online newspapers. The newspapers were chosen through the purposive sampling method. To collect articles on food poisoning cases, we used the keyword "food poisoning" to searching on each online newspaper.

2.3. Statistical analysis

We used Zotero and Excel software to store and manage data. The information on food poisoning cases was classified by each food group causing poisoning, time of reporting, victim's occupation, age, gender, number of people poisoned, number of people dead, and the location where the poisoning occurred.

3. Results

3.1. Foods that cause poisoning

A total of 184 articles were collected from seven popular Vietnamese online newspapers for this study. Among the 184 articles, there are 3711 food poisoning cases, that's equivalent to 3711 people who have been reported to have food poisoning in Vietnam from March 2020 to August 2022. Food poisoning can be divided into 4 groups including food of animal origin, food of plant origin, alcohol, and other products. In the food of animal origin group, patient tends to eat uncommon animals such as strange fish or snails; these are poisonous animals and rarely appear in the diet. Patients also eat organs or eggs of marine animals. We found that 14.6% of poisoning cases were caused by eating toads and offal of this amphibian. Insects such as cicadas, bugs, crickets, and *Cantharis vesicatoria* account for 24.4% of all food poisoning cases of animal origin. In addition to food containing toxins, food poisoning also

Table 1

Foods that cause poisoning.

Group of food	Type of food	Ingredient	Cook	Region
Animals	Turtle			Cao Bang
	Seafish		Fried	Dong Nai
	Carp	Gallbladder, Gallbladder, intestine	Intestine soup, gallbladder wine	Cao Bang, Bac Kan
	Sea eel		Hot pot, grill	Vung Tau
	Red snapper	Red snapper		Binh Thuan, Da Nang, Vung Tau, Binh Phuoc, Binh Phuoc
	Snakehead fish	Snakehead fish	Store at room temperature	
	Toad	Toad		Hoa Binh
	Devil crab	Devil crab	Boil	Thanh Hoa
	Toad	Skin, eeg		Quang tri
	Crickets	Crickets	Fried	Long An
	Seafood	Baby octopus (Octopus dollfusi), Squid		Quang
		Gallbladder		Ninh, Ba Ria - Vung Tau
	Monkey	Termite	Raw	Quang Binh
	Termite	Termite	Roast	Ha Noi
	Chicken, pork	Chicken, pork	Boil	Lai Chau
	Cicada	Cicada		Dak Lak
	Sea snail	Sea snail	Steam, Boil	Khanh Hoa, Quang Ngai
	Egg & fish	Egg & fish		Dong Nai
	Insect (Cantharis vesicatoria)	Insect (Cantharis vesicatoria)	Dry	Nghe An, Son La, Gia Lai
	Mangrove horseshoe crab	Mangrove horseshoe crab		Soc Trang
Plant and vegetable	Calf	Calf	Grill	Ha Tinh
	Mouse	Mouse & Wine		Kon Tum
	Toad	Toad, toad egg	Grill	Dien Bien, Hoa Binh, Tuyen Quang
	Cicada chicken	Cicada chicken		Binh Phuoc
	Pork and egg	Pork and egg	Stew, Roast	Tay Ninh
	Insect Silver chimaera	Cicada, Bug Stomach		HCM City, Hoa Binh, Tay Nguyen
	Spotted gar	Egg		HCM City
	Datura	Datura	Boil	Ha Noi
	Orange & water melon		Raw	Lao Cai
	Vernonia amygdalina	Cooked with fish intestine		Quang Ninh
	Bitter vegetable	Flower and leaves	Stir-fried	Bac Kan
	Poppy plant	Poppy plant	boil	Lao Cai
	Mushroom	Soup		Lang Son
	Root of the Aconitum	Soup		Dak Lak
	Fortunei Hemsl			Tuyen Quang
	Strange root	Strange root	Cooked	
	Indian three-leaved yam (Dioscorea hispida)	Indian three-leaved yam (Dioscorea hispida)		Lao Cai
	Cassava tubers	Cassava tubers		Quang
	Jicama	Jicama Mexican yam bean seed	Raw	Ninh, Lao Cai
	Mexican yam bean			Lao Cai
	Irwin & Barneby	Irwin & Barneby seed	Raw	Lao Cai
				Phu Tho
				Kien Giang

(continued on next page)

Table 1 (continued)

Group of food	Type of food	Ingredient	Cook	Region
Alcohol	Bell flower	Bell flower	Stir-fried	Lao Cai
	Sycamore leaves	Sycamore leaves		Hoa Binh
	Dog's mercury	Dog's mercury		Nghe An
	Gelsemium elegans	Gelsemium elegans	Boil, Stir-fried, Boil	Hoa Binh, Bac Kan, Lang Son, Lang Son
	Mushroom	Mushroom	Cooked, Grill, Soup	Ha Giang, Ha Tinh, Quang Binh, Ha Giang, Dien Bien, Quang Ngai, Yen Bai, Quang Nam, Son La
	Pineapple & Fish mint	Juice	Juice	Cao Bang
	Capparis versicolor Griff	Capparis versicolor Griff		Lao Cai
	Wild fruit	Bayberry	Stir-fried	Ha Giang
	Sea water spinach	Sea water spinach		Quang Binh
	Wild vegetable	Flower and leaves		Bac Kan
	Vegetable	Vegetable	Raw	Hung Yen, Thai Binh
	Cassava tubers	Cassava tubers	Boil	Dak Lak, Lao Cai
	Cinnamon oil	Cinnamon oil	Drink	Thanh Hoa
	Capparis versicolor Griff	Capparis versicolor Griff	Eat	Lao Cai
	Mango	Mangi	Eat	Ha Giang
	Wine	Industrial alcohol, Pickled wine	Ickled, Pickled	Phu Tho, Cao Bang, Lao Cai, Ha Noi, Ben Tre, Nghe An, HCM City, Long An, Hai Duong, Binh Thuan, Quang Ninh, Dien Bien, Ha Giang, Hoa Binh, Phu Tho, Lam Dong, Lao Cai, HCM City
	Ethanol	Ethanol		Quang Ninh, Tay Ninh, Dong Nai, HCM City, Ha Noi, Vinh Long, Ben Tre, Ca Mau, Lam Dong, Vinh Phuc, Bac Giang, Bac Ninh, Nghe An, Ben Tre
	Methanol	Methanol		Quang Ninh
	Antiseptic alcohol	Antiseptic alcohol		Khanh Hoa
	Alcohol mixed with water	Alcohol mixed with water		

Table 1 (continued)

Group of food	Type of food	Ingredient	Cook	Region
Cake & Bread	Beer mix with alcohol	Beer mix with alcohol		Khanh Hoa
	Cake	Bread soup & choux cream, Floating cake	Baked, Boil	HCM City, Lao Cai, Ha Giang, Ha Noi
	Bread	Bread	Baked	Dak Lak, Quang Ngai, Lam Dong, Quang Ngai, Lao Cai
Vegetarian food	Rice paper mix	Rice paper mix	Mix	Da Nang
	Vegetarian food	Tofu, noodle, Pate	Cooked	Binh Duong, Da Nang, HCM City, Quang Nam, Binh Duong, Dong Nai, Khanh Hoa, Quang Nam, Nam Dinh, Ha Noi, Da Nang
	Other food	Pho	Cooked	Lao Cai
	Sour soup	Sour soup		HCM City
	Mango sweet soup	Mango		Ha Noi
	Canteen food	Pork, cabbage, soup		Cao Bang, Ha Noi
	Soft drink	Soft drink		Hai Phong
	Pizza	Sausage	Baked	Ha Noi
	Beef with bordelaise sauce		Cooked	Ha Noi
	Sticky rice			Nghe An
	General food	Pork, sausage, tofu, sausage, fish, cabbage, bread, cake, rice, salad, pork, chicken, seafood		Bac Ninh, Nghe An, Thanh Hoa, Quang Ninh, Quang Nam, Lam Dong, Dak Nong, Kon Tum, Da Nang, Vung Tau, Tuyen
		salad, squid, shrimp, fish, snail, Vegetarian roll & Char siew		Quang, Dong Nai, Ha Noi

comes from the fact that food is processed in unsanitary conditions, creating conditions for harmful microorganisms to grow. With food poisoning cases of plant and fungal origin, patients often use wild vegetables, wild fruits, or wild mushrooms without knowing about their safety. Among 42 articles of food poisoning with this type of food, there are 14 articles related to eating wild vegetables and poisonous leaves, accounting for 33.3%. This was followed by articles on poisoning cases caused by eating poisonous mushrooms in the wild, accounting for about 23.8% of reports on food poisoning from plants and mushrooms. These cases are often seen in citizens in mountainous areas, with limited knowledge about the toxicity of wild plants and fungi. The most remarkable are the reports of alcohol poisoning and industrial alcohol containing high levels of methanol. In the case of poisoning from alcoholic beverages only, there were 41 articles. Most of the victims consumed a large amount of industrial alcohol with high methanol content, causing acute poisoning. A few were poisoned when drinking alcohol mixed with other ingredients. As for the remaining food poisoning cases, the main cause was the unsanitary way of processing and cooking, which caused food to be contaminated with dangerous

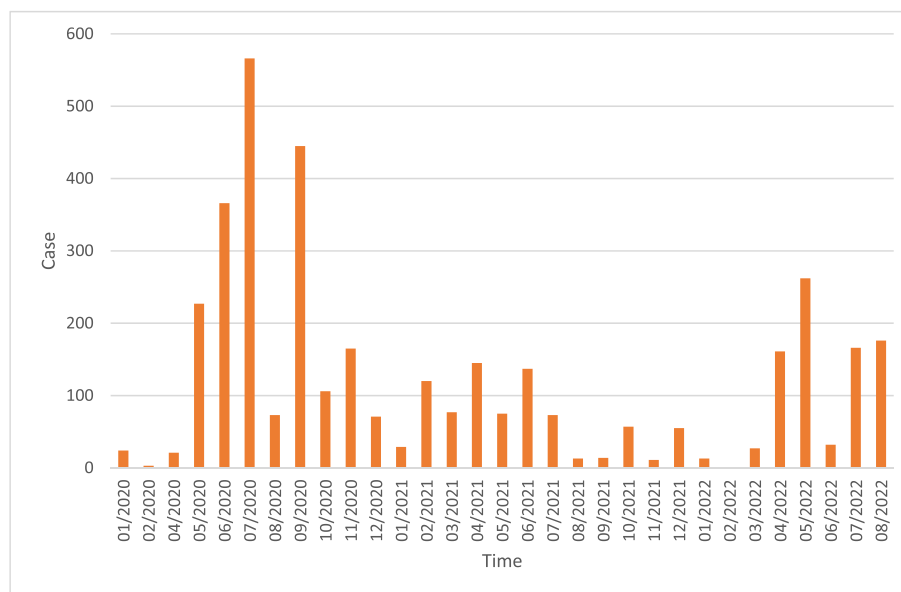


Fig. 1. Poisoning cases over time from January 2020 to August 2022. There was no specific rule on the number of food poisoning cases during that time. The greatest number of food poisoning in July 2020 (566 cases), followed by September 2020 (445 cases) and June 2020 (336 cases). The food poisoning cases seem to be on a downward trend in 2021 and 2022.

toxins such as botulinum (Table 1, Fig. S1, Fig. S2, and Fig. S3).

From the data we have collected over the past 2 years, all provinces in Vietnam have reported cases of poisoning from many different foods. Interestingly, the two largest cities and economic centers in Vietnam lead the way in the number of reported articles of food poisoning in the past two years: Ho Chi Minh City with 14 (7.6%) articles and Hanoi with 15 articles (8.2%). It is followed by Son La, a mountainous province in the north of Vietnam with 13 articles between 2020 and 2022 (Table 1).

3.2. Reported cases of poisoning food

Table S1 showed the case of food poisoning. The objects of food poisoning include citizens, workers, tourists, students, and fishermen. 9 persons were poisoned and 4 died in the most severe episode of alcohol poisoning in Ba Tri district, Ben Tre province. Six serious cases were brought to the hospital; three of them passed away soon after being poisoned. Industrial alcohol's major ingredient, methanol, is responsible for the body's harmful reaction. Mouth foaming and blurred vision are common signs of toxicity when this substance is consumed. A normal, healthy adult can die with just 30ml of methanol. Therefore, methanol-containing alcohol should not be consumed. In additions, there was one occurrence of unidentified-cause poisoning in the province of Hung Yen in 2020–2022, which occurred after a family lunch of pork, pork rolls, fried eggs, and celery. In this instance, nine people were poisoned and had abdominal pain, vomiting, convulsions, and mouth foaming. 4 of the 5 hospitalized patients were in critical condition before they passed away, while the final patient passed away after receiving care for more than a month (Table S1).

The number of food poisoning cases varies from period to period and there is no specific rule. The highest incidents of poisoning were reported in 2020, particularly during the year's middle months (May, June, July, and September). The region saw the greatest number of poisoning occurrences during the study period in July 2020 (566 cases), followed by June and September 2020 with 336 cases and 445 cases, respectively. There are 227 and 262 instances of food poisoning in May of both 2020 and 2021, respectively. 160–180 cases of poisoning reported in April, July, and August of 2022 are not significantly different from the statistics. The year 2021 saw the fewest incidents of poisoning, primarily due to the low possibility of poisoning in the first half of the year. As evidenced by the data, the number of poisoning cases in the

month of February, April, and June (between 120 and 145 each month) nearly doubled the month of March, May, and July (between 73 and 77 cases each month). The lowest number of poisoning cases during the research period were reported in the first quarter of 2020, the two months August and September of 2021, and the first quarter of 2022. In particular, March 2020 saw no incidents of food poisoning, while March 2022 saw the largest number of poisoning patients throughout this stage (27 cases) (Fig. 1).

The number of cases in 63 provinces of Vietnam within 2 years (2020–2022) is uneven (Fig. 2). The poisoning cases in the North and the Central region was recorded less, while in the South, the poisoning cases was recorded more, mainly in the provinces of Lam Dong (438 cases), Dong Nai (443 cases), and Ho Chi Minh City (464 cases). However, Da Nang city in the Central region reported the highest number of food poisoning cases (699 cases). Most of which were alcohol poisoning, vegetarian pate, and sea snails. An Giang, Bac Lieu, Can Tho, Hau Giang, Phu Yen, Thai Nguyen, Thai Binh, Thua Thien - Hue, Tien Giang, and Tra Vinh are 10 provinces that have not recorded any cases of food poisoning during the study period from 2020 to 2022.

4. Discussion

Based on previous reports, we supposed animals, plants, alcohol, and other products as the original cause of foodborne illness in humans [14–16]. Interestingly, alcohol poisoning accounted for the highest rate in our study. This finding reflects the traditional customs in Asian countries, especially alcohol drinking habit in male. However, the current rate of repeated drinking in Vietnam is lower than the rate commonly found in Western countries [17]. Our study also found that alcohol is among the leading causes of death. The explanation for this is that alcohol, especially industrial alcohol contains a high amount of methanol. As soon as methanol enters the body, it is metabolized to highly toxic formic acid. The accumulation of formic acid causes the body to become acidic, inhibiting the activity of the mitochondria's cytochrome oxidase, causing histotoxic hypoxia [18]. The sensitivity to formic acid is particularly high in the brain and visual pathway [19]. This problem arises due to excessive concentrations of methanol formed during incorrect distillation processes, especially when methanol is deliberately added to illicit alcoholic beverages and spiritous drinks produced informally. Plants and forest leaves are also able to cause food

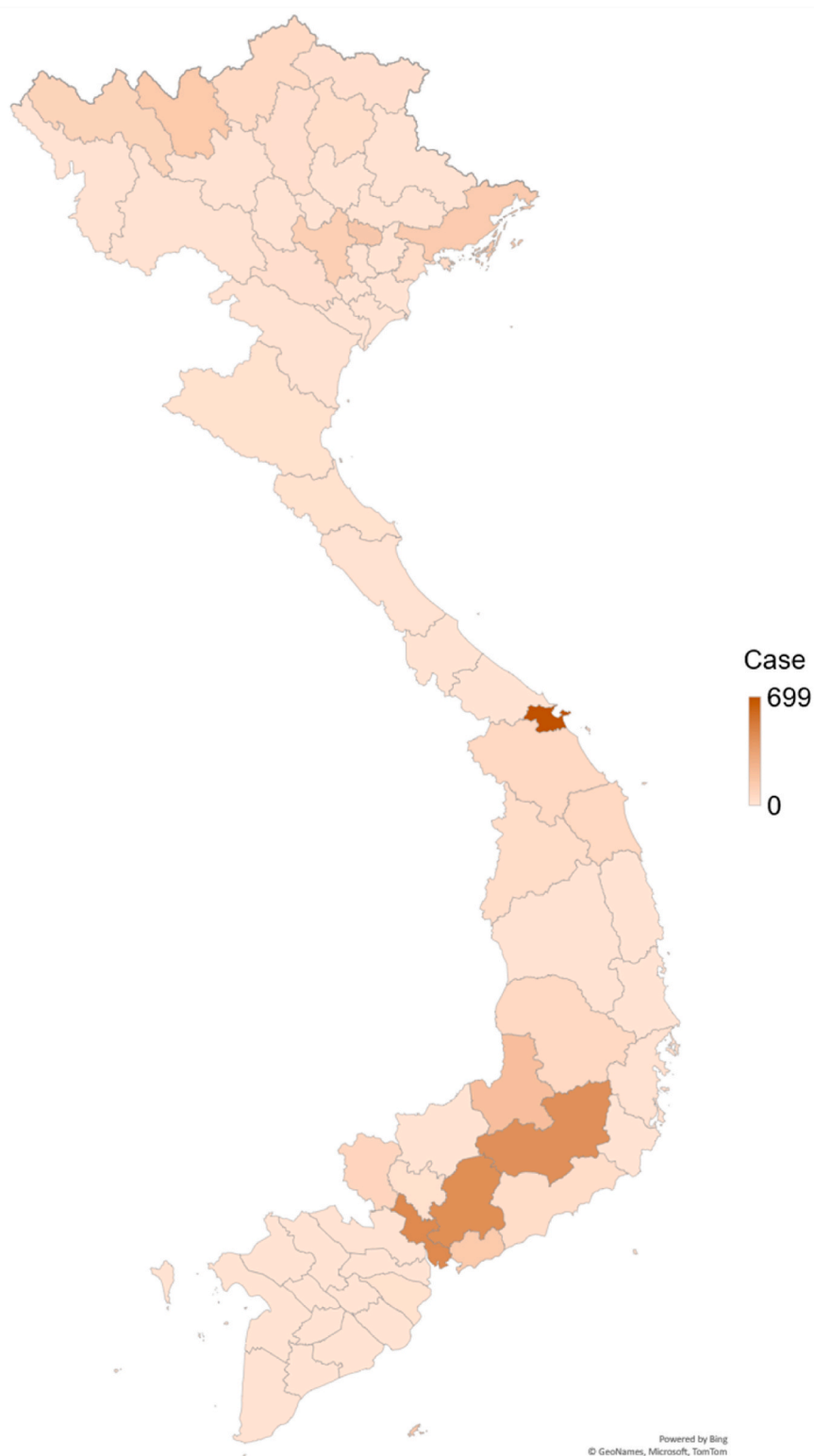


Fig. 2. Poisoning cases by the province in Vietnam from 2020–2022. Number of cases of food poisoning in Vietnam has varied between 63 provinces in Vietnam within 2 years. The provinces with the highest number of poisoning cases have often been the largest economic and tourism development in the country, such as Da Nang (699 cases), Ho Chi Minh City (464 cases), Dong Nai (), Hanoi ().

poisoning. Vietnam is one of the well-known countries for high biodiversity. Therefore, the vegetation in Vietnam is very diverse and many plants among them contain toxic substances. Furthermore, people's knowledge and awareness are still limited. They do not have the enough knowledge to identify inedible plants and fungi.

Regarding the subjects of food poisoning, citizens are the most common victims of food poisoning because they are the largest group in the community. However, Stephanie Fletcher et al. in Australia indicated that tourists are the main target and most susceptible to food poisoning [20].

Remarkably, the number of food poisoning victims was lowest in the first quarters, while the highest number was reported in the third quarter of the year. This is in agreement with the study of Torrung Vetchapitak et al. [21]. Microorganisms are the direct agents that cause spoilage and contamination of food. Microorganism development is directly influenced by factors in the surroundings, such as temperature, light, chemicals, radiation, pH, and many other things. In Vietnam, the third quarter of the year is the rainy season; the climate is hot and humid. This is the ideal habitat for microorganisms. That is why many cases occur in such period of time.

The General Statistics Office for Vietnam (GSOV) has reported that Ho Chi Minh City and Hanoi have the highest population density among Vietnam's major cities [22]. A total of 9.22 million people inhabited in Ho Chi Minh City, whereas 8.24 million people lived in Hanoi, in the second place. Accordingly, our study was conducted in these two cities, and it was found that they had a higher rate of food poisoning than any other city in the country as a result. Interestingly, Son La ranked third among all provinces in Vietnam in terms of the number of food poisoning cases reported. Son La, a mountainous province in the North of Vietnam, is a place with high biodiversity. Due to its tropical monsoon climate, Son La has cold and dry winters, hot and humid summers, and plenty of rains during the months of July and August [23]. This is a suitable condition for many species of plants, animals, and microorganisms to grow and develop.

To prevent food poisoning, Vietnam has introduced policies to protect users such as penalizing places that provide dirty food and at the same time publishing information about ensuring food hygiene and safety. However, these regulations still have loopholes, leading to a lack of food safety and hygiene. To overcome this situation, Vietnamese law has been adjusted and supplemented, especially regulations on food safety and hygiene.

There are limitations in our study. First, the study did not assess the extent of food poisoning of each specific food. Secondly, it is challenging to process data since data sources from Vietnamese online media might be easily copied. Finally, poisoning information from different years is not uniform.

Food poisoning is a problem in Vietnam and other countries in the world. This is a dangerous disease if not treated properly [24]. To limit food poisoning, we offer the following corrective strategies. First, consumers need to be educated about food recalls and the proper handling, storage, and cooking process of foods [25]. For example, food should be fresh, hygienic, fully cooked and stored properly. In order to prevent food poisoning, consumers need to wash hands before cooking and eating, and should not try uncommon food or food possibly containing toxins. They need to buy food from places of clear origin. Currently, diagnosis and management of foodborne illness are based on history and physical examination. There are no specific symptoms associated with foodborne illness, so clinicians must assess the patient's history, epidemiology, and objective findings to make an accurate diagnosis. A physical examination can aid in confirming the differential diagnosis, and vital signs can help clinicians determine the severity of volume depletion [26]. Furthermore, it is pertinent to note that prevention strategies are meant to deal with outbreaks once they have already occurred. More importantly, education through media and food recalls should be focused more.

5. Conclusion

The present study collected the food poisoning cases through seven popular Vietnamese online newspapers from March 2020 to August 2022. A total of 184 articles were collected with 3711 food poisoning cases. Several types of food such as mushrooms, toads, alcohol, pate, seafood and insects have been reported to be cause of several poisoning cases and separated into 4 groups including food with animal origins, food with plant origins, alcohol and other items. It's worth noting that Ho Chi Minh and Ha Noi, Vietnam's two big cities and economic hubs,

have recorded the most incidents of food poisonings over the past two years with 14 articles (7.6%) and 15 articles (8.2%). Son La province, a mountainous region northern Vietnam, come in third with 13 articles between 2020 and July 2022. Food category that caused the poisoning, the time of reporting, the victim's occupation, age, and gender, the total number of poisoned persons and deaths, and the location of the incident were related factors with information on food poisonings cases. Our research is a useful reference for studies with a broader scale and a richer participant in the future. Finally, consumers need to be aware of dirty foods, food poisoning or foods of unknown origins. In addition, the competent authorities need to coordinate with related parties improve the ability to control food safety as well as to get rid of unqualified production facilities.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data is included in the manuscript

Acknowledgment

We would like to thank Ms. Luong Yen Nguyen and Ms. Thuy-Duong Vu, the members of the Center for Biomedicine and Community Health, International School, Vietnam National University, Hanoi, Vietnam for partially collecting references and checking to improve the manuscript.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.cscee.2022.100295>.

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