

Outbreak Reports

Poisonings Caused by Wild Mushroom Containing Amanitin Toxins — Shaoxing City, Zhejiang Province, China, 2019

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Summary

What is already known about this topic?

Among all food poisoning, poisonings caused by wild mushrooms containing amanitin toxins have the highest case fatality rate. Amanitin toxins can cause acute liver function damage, and symptoms of the poisoning can include vomiting and diarrhea in early stages and progressive liver damage 2–3 days later.

What is added by this report?

Before 2019, there were about 1–2 cases of wild mushroom containing amanitin toxins poisoning each year in Zhejiang Province. In 2019, 10 cases were identified through disease investigation and toxin detection and biological identification in Shaoxing City, Zhejiang Province. All patients had a history of wild mushroom consumption.

What are the implications for public health practice?

In the summer, some people collect the wild mushrooms for consumption. In China, about 20 species of mushrooms can cause death, and most people lack the ability to identify which mushrooms are edible. To combat this, effective science popularization and prevention and control work will be able to reduce the occurrence of related poisoning events.

toxins. Through popular science publicity and education on wild mushroom poisonings and the prohibition of wild mushroom collection/consumption, similar poisoning events were reduced until the middle of August.

INVESTIGATION AND RESULTS

The Xinchang County CDC of Shaoxing City, Zhejiang Province, received an event report from a local hospital that 6 patients in a family went to a doctor with suspected food poisoning on June 29, 2019. The local CDC in Shaoxing immediately carried out an epidemiological investigation and found that the patients had the gastrointestinal irritation symptoms including nausea, vomiting, and diarrhea in the early stages. The patients then developed different degrees of liver function damage with symptoms including abnormal increase of glutamic pyruvic transaminase and glutamic oxaloacetic transaminase between 40–72 hours following consumption. One patient was found to be in severe condition upon rescuing and died. All other patients had improved conditions after medical treatments and were discharged from the hospital one week later. On July 11, the Shaoxing City CDC received a report from that local hospital of another 2 patients with similar symptoms. The national, provincial, and local CDC organized a joint survey team to carry out an epidemiological investigation.

From June 22 to July 25, 2019 in Shaoxing City, Zhejiang Province, case searching was carried out. The criteria included patients with symptoms of gastrointestinal irritation such as nausea, vomiting, and diarrhea appearing in early stages and then progressing to acute liver function damage within 12–72 hours with no obvious fever in the course of the disease.

The professionals of the local CDC carried out case searching in medical institutions within their jurisdiction by interviewing the patients that met the case definition, their families, and the medical staff involved in the treatment of the patients, collecting

BACKGROUND

From June 28 to July 15, 2019, 3 suspected poisoning events continuously occurred in Shaoxing City, Zhejiang Province, China. A total of 10 patients with different degrees of liver damage were found, and 1 patient died so the case fatality rate was 10%. The agencies for disease control and prevention formed a team to investigate this incident. Using a combination of epidemiological investigations, laboratory toxin analysis, and biological identification results of poisonous samples, the poisoning events were determined to be caused by the ingestion of a wild mushroom (*Amanita rimosa*) containing amanitin

their medical records, and making household hygiene survey in the villages where the incidents occurred. The plasma/urine samples of the patients were collected and detected with α -amanitin by the Zhejiang Provincial CDC. Wild mushrooms were collected and detected as poisonous by the Zhejiang Provincial CDC and was identified with molecular biology by China CDC.

Until July 25, a total of 10 patients meeting the case definition were found including 6 patients in Xinchang County, 2 patients in Keqiao District, and 2 patients in Zhuji County.

All patients came from three families in Shaoxing City, which lived tens of kilometers apart. The members of the three families did not know each other, nor did they have any other common exposure factors. All patients became sick 10–22 hours after their family dinners. The consumption dates for three families were on June 27–28, July 10, and July 15. Family members who did not participate in the dinner did not become sick.

Field investigations revealed that the meals of the three families were relatively simple and mainly included fried vegetables, soups, and staple foods such as rice. All foods were cooked and eaten as soon as possible, and no individuals were in contact with raw or cold foods. The wild mushrooms were collected on mountains near their residence and were one of the main foods. From June 27 to 28, 7 people had dinner together in Xinchang County, 1 person ate noodles cooked with wild mushrooms, 6 persons (including the aforementioned individual) ate wild mushroom soup containing bamboo, and these 6 persons became sick; the remaining individual was a child who did not consume the wild mushroom and developed no disease. On July 10, 2 individuals in Keqiao District picked and ate a variety of cooked wild mushrooms for dinner. On the morning of July 11, both became sick. On July 15, 2 persons in Zhuji County ate wild mushroom soup collected by themselves for lunch and

dinner, and both presented poisoning symptoms. Besides wild mushroom consumption, there were no other shared risk factor exposures between the patients. Therefore, wild mushroom consumption was identified as the exposure risk factor.

The morbidity timeline, place, and population distribution of poisoning patients are shown in [Table 1](#).

Through interviewing the patients and their family members in three families, we found that all the wild mushrooms eaten by the patients were picked in the mountains near their residence and were white mushrooms with similar biological morphology. The investigation team immediately collected mushroom samples in the fields the patients identified. The mushrooms were confirmed by the patients and were sent to the laboratory for toxin detection and biological identification.

The clinical characteristics of all patients were as follows: 1) The latent period was between 10 hours and 22 hours; 2) the initial symptoms were gastrointestinal irritation including nausea, vomiting, abdominal pain, diarrhea, etc.; 3) 36–72 hours post-consumption of wild mushroom, liver function damage appeared and a death occurred as a result of acute liver failure; 4) about a week after of symptomatic support treatment, the liver function of the patients gradually recovered; and 5) there were no fever symptoms in the course of disease. The development of clinical symptom was consistent with the characteristics of acute toxic liver damage (1–3).

The clinical manifestations of poisoning patients are shown in [Table 2](#).

The patients' plasma samples from their first day in the hospital were collected. The mushroom toxin α -amanitin in samples were detected by liquid chromatography with tandem mass spectrometry (LC-MS/MS). The toxins were found in 8 patients' plasma samples. The contents of α -amanitin in plasma were between 0.016–1.11 ng/mL. The toxins could not be

TABLE 1. The morbidity time, place, and population distribution of the poisoned patients

Meal events	Total number at meal	Number of consuming wild mushrooms	Poisoned patients	Poisoning sites	Time of consumption	Time of first case	Time of last case	Latent period (hours)
Xinchang 1	1*	1	1	Home	Jun 27, 7:00	Jun 27, 17:00	–	10
Xinchang 2	7	6	6	Home	Jun 28, 18:00	Jun 29, 5:00	Jun 29, 16:00	11–22
Keqiao 1	2	2	2	Home	Jul 10, 17:00	Jul 11, 8:00	Jul 11, 8:00	15
Zhuji 1	2	2	2	Home	Jul 15, 12:00	Jul 15, 22:00	–	10
Zhuji 2	2	2	2	Home	Jul 15, 18:00	Jul 15, 22:00	Jul 16, 4:00	10

* This patient consumed the poisonous mushroom twice and died.

TABLE 2. The clinical manifestations of the poisoned patients in the 3 areas.

Clinical characteristics	Xinchang	Zhuji	Keqiao	Total
Patients with gastrointestinal irritation				
Nausea and vomiting	5	2	2	9
Abdominal pain	6	2	2	10
Diarrhea	6	2	1	9
Patients with liver function damage				
Glutamic-pyruvic transaminase (GPT/ALT) and glutamic-oxaloacetic transaminase (GOT/AST)	6 (Up to 55 times higher)	2 (Up to 110 times higher)	2 (Up to 25 times higher)	10

detected in 2 patients' plasma samples 30 hours and 50 hours post-consumption of the mushrooms. The toxins were found in 2 patients' urine samples 62 hours and 51 hours post-consumption and the contents were 0.069 ng/mL and 1.24 ng/mL, respectively.

The wild mushroom samples were found to have α -Amanitin and β -amanitin, and the average contents in the dried samples were 8.63 mg/g and 2.57 mg/g, respectively.

Molecular identification was based on internal transcribed spacer (ITS) sequences. Based on morphological and molecular studies, the suspected mushroom was identified as *Amanita rimosa* (4-5) Figure 1. The contents of α -amanitin and β -amanitin in the sampled mushroom specimens were similar to those in previously reported *Amanita rimosa* (6).

PUBLIC HEALTH RESPONSE

After the cause of poisoning was determined, the CDCs in Shaoxing city immediately carried out the popular science publicity and education about wild mushroom poisonings and prohibited residents from



FIGURE 1. Basidioma of *Amanita rimosa* (white bar= 1 cm). *Amanita rimosa* grows on the ground in broad-leaved forest dominated by the Fagaceae family of trees. Basidiocarp: small; pileus: 3–5 cm in diameter, white to whitish, middle white to slightly darker; stipe: white to whitish; volva: white; limbate annulus: subapical, white.

picking and eating wild mushrooms. No similar poisoning incidents occurred until August 15, 2019.

The local CDC also suggested regularly carrying out the popular science publicity and education of toxic mushroom poisonings before the rainy season (from the middle of June to the middle of July) in the future. They also decided to set up warning signs prohibiting the picking and eating of wild mushroom in mountain areas to prevent such incidents.

DISCUSSION

The rainy season in Zhejiang Province is from the middle of June to the middle of July every year and the average temperature is between 20 °C–30 °C, which are suitable temperatures and humidity for the growth of wild mushrooms (7). Some local mountain residents often consume wild mushrooms, but it is difficult to distinguish edible or toxic wild mushrooms for most residents. There is the possibility of poisoning in the collection and ingestion of toxic wild mushrooms.

The case fatality rate of wild mushroom poisonings with amanitin toxin is reportedly about 20% (2). The increase in transaminase levels of poisoning patients generally occurs 48–72 hours following consumption and the optimal treatment period is before 36 hours (8). Toxin detection should occur as early as possible to determine the cause of the disease and carry out effective interventions and treatment in time.

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