

Epidemiologic Investigation of a Cluster of Deaths due to Eating Fried Rice Balls Intentionally Tainted with Quinalphos, Sironko District, Uganda, a case series, 2017

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ABSTRACT

Background: Quinalphos is an organophosphate chemical chiefly used as a pesticide. On 13 November 2017, a cluster of unexplained deaths was reported in Village X, Sironko District, Eastern Uganda. We investigated to identify the scope and exposures for the cluster of deaths, and recommend control-measures. **Case Presentation:** We defined a suspected case as acute onset from 1-11 November 2017 of abdominal pain plus ≥ 1 of the following: vomiting, nasal bleeding, sweating, confusion, convulsion, loss of consciousness in a Village X resident. A confirmed case was a suspected case with a positive toxicological test of quinalphos by liquid chromatography. We reviewed clinical records and conducted active community case-finding. We investigated the exposure histories of case-patients, and inspected their homes for potential exposures. We identified 4 cases (including 1 confirmed) from a single household. The age range was six to fifty-two years; attack rate: 50%, 4/8, and case fatality rate: $\frac{3}{4}$ 75%. Symptoms included abdominal pain (100%), vomiting (75%), self-reported fever (50%), confusion (25%), convulsion (25%), loss of consciousness (25%), nasal bleeding (25%). Of the 4 case-patients, 3 had onset at 09:00hours and 1 at 19:00hours on 9 November 2017. The 4 case-patients shared 5 “bolingos” (fried rice balls) at 14:00hours, which had been given to case-patient A, a primary two level pupil (equivalent to the second grade in the US system) by an unknown person on her way home from school on 8 November. Case-patient A ate 1 bolingo and died within 35 hours, case-patient B ate 2 bolingos and died within 27 hours, case-patient D ate 1½ bolingo and died in 45 hours, case-patient C ate ½ bolingo, developed mild symptoms and survived. Additionally, 8 chickens also ate crumbs of the bolingo and died. A blood specimen of the lone survivor tested positive for quinalphos. After reading our report, police conducted a criminal investigation and found that the affected family had land disputes with a neighbour. One man was arrested and is awaiting trial. **Conclusion:** This fatal food-poisoning cluster of deaths was caused by eating bolingos (fried rice balls) intentionally tainted with quinalphos. We recommended strict control of pesticides, assessment of availability and use of pesticides in communities, and re-orientation of clinicians on case-presentation and management of organophosphate poisoning.

KEYWORDS

Organophosphate; Food poisoning; Uganda; Death

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Background

Acute pesticide poisoning accounts for significant morbidity and mortality worldwide, especially in developing countries [1]. The World Health Organization (WHO) estimates three million cases of pesticide poisoning occurring every year resulting in an excess of 250,000 deaths and temporary or permanent disabilities [2]. Pesticides are produced in an ineffectively regulated manner and sold by unregistered vendors on the streets and in market places in Sub-Saharan Africa [3].

Quinalphos, an organophosphate, is chiefly used as a pesticide. It is classified as being moderately hazardous in the acute hazard ranking of the WHO [4]. The use of quinalphos is either banned or restricted in most nations [4].

On 13 November 2017, Uganda Ministry of Health received notification of sudden and unexplained death of 3 people from the same household in Village X, Sironko District, Eastern Uganda. We investigated to establish the cause and scope of the cluster of deaths, determine exposures, and recommend control measures.

Case presentation

At 14:00 hours, 8 November 2017, an eight-year old pupil (case-patient A) of the primary two level (equivalent to the second grade in the US system) came back home from school with 5 *bolingos* (fried rice balls), which were given to her by an unknown person on her way home. The school is approximately 400 metres away from her home. Case-patient A shared the *bolingos* with some of her family members. Case-patient A ate 1 *bolingo*, case-patient B ate 2 *bolingos*, case-patient C ate ½ *bolingo*, and case-patient D ate 1½ *bolingos*. Pieces of the *bolingos* fell to the floor in the house as they were broken for sharing. Eight of household 10 chicken ate the crumbs.

At 21:00 hours on the same day (8 November 2019), the family of eight shared a meal, which had sweet potatoes, yams, and eggplants, and drank water from a common pot.

At 6:00 hours, 9 November 2017, the family awoke up, and found that eight chickens (four adults and four chicks) had died. By 9:00 hours, the three

children in the family (case-patients A, B, and C) had started developing illness.

Case-patient A: an eight-year-old girl, developed abdominal pain, confusion, convulsion, perceived fever, nasal bleeding, headache, and vomiting. She was taken to clinic I and died at 3:15 hours on 10 November 2017. Only a malaria test (result: negative) and Haemoglobin test (Hb: 10g/dl) were done.

Case-patient B: a nine-year-old girl, developed abdominal pain, fever (self-reported), vomiting, and convulsion. She was taken to clinic F, which referred her to hospital G, but the mother preferred to take her to her father, who was staying in a neighbouring district. Her father took her to clinic H where she was given normal saline, dexamethasone and hydrocortisone and referred again to hospital G but died on her way to hospital G at 17:00 hours on the same day (10 November 2017).

Case-patient C: a six-year-old girl, developed vomiting and abdominal pain. She was taken to a drug shop for first aid, where she received an unknown medication. This patient recovered. A blood sample was collected from her and taken to the Government Analytical Laboratories for toxicology analysis. Her blood tested positive for quinalphos using the liquid chromatography-mass spectrometry triple quadruple test [5].

Case-patient D: the 50-year-old grandmother of case-patients A-C, collapsed at 19:00 hours, and was taken to clinic J. Case-patient D presented with abdominal pain, chest pain, and loss of consciousness. Tests and clinical examinations performed for case-patient D included: Armpit temperature (35.8°C), malaria (negative), typhoid (negative), *Brucella Abortus* using the serum agglutination test (negative), random blood sugar (100.3mg/dl: ranges 72-108mg/dl), and blood pressure (100/70mmHg). She was managed with diclofenac, normal saline, ceftriazone plus quinine, and died at 11:00 hours on 10 November 2017.

In addition to human cases, eight chickens also died, all of which had eaten *bolingo* crumbs that had fallen to the ground when case-patient D shared the *bolingos* among the family members.

Epidemiologic characteristics of the cases

Four of the eight persons in the same family developed illness (Attack rate: 50%), of these, one (25%) was laboratory confirmed. Out of the four case-patients, 3 died (case-fatality rate: 75%. All 4 case-patients were females, with an age range of 6-50 years. Symptoms included abdominal pain, vomiting, fever, chest pain, confusion, convulsion, loss of consciousness and nasal bleeding ([Table 1](#)).

Discussion and Conclusion

Organophosphate compounds are possibly the most widely used pesticides in the world [\[6\]](#). While Uganda is a signatory to several conventions and agreements related to the management of hazardous chemicals, the implementation of the clauses in these agreements is inadequate [\[7\]](#). Access to these hazardous products is easy in Uganda, which can result in serious health threats [\[8\]](#). Diagnosis of mild to moderate organophosphate poisoning is frequently difficult as demonstrated in this investigation, since symptoms are non-specific and mimic other common disorders [\[9, 10\]](#).

The acute toxicity of organophosphates is due to the inhibition of the enzyme acetylcholinesterase by phosphorylation, resulting in an accumulation of acetylcholine at postganglionic parasympathetic nerve endings (muscarinic receptors), parasympathetic ganglia (nicotinic receptors), and neuromuscular junctions (nicotinic receptors). All organophosphates inhibit both red cell acetylcholinesterase and plasma cholinesterase, which provides the basis for biological monitoring of toxicity [\[11\]](#). Severity and outcome of organophosphate poisoning depend on patients' characteristics (age, general health status, etc.) as well as the dosage. During this scenario, case-patient C took the smallest amount of *bolingo* of all four case-patients, which might have explained why she survived.

Early symptoms of acute exposure to organophosphates are non-specific; subsequent clinical manifestations are more characteristic. In mild to moderate poisoning, symptoms can include headache, blurred vision, miosis, excessive salivation, nausea, vomiting, lacrimation, sweating, wheezing and lethargy. Severe poisoning may cause

coma, convulsions, respiratory muscle paralysis, bradycardia and hypotension [\[11, 12\]](#). The four case-patients during this investigation presented with symptoms consistent with organophosphate poisoning.

The first step in managing acute poisoning is to maintain a clear airway and ensure adequate ventilation; after which atropine should be given. Pralidoxime (a specific cholinesterase reactivator) should also be started within four hours of exposure [\[11\]](#). Supportive treatment include oxygen support, intravenous fluids, and maintaining electrolyte balance [\[13\]](#). None of the case-patients during this investigation received ideal care and management. First, care-seeking was delayed. Secondly, the case-patients were taken to clinics which did not have health workers competent for managing organophosphate poisoning, leading to misdiagnosis and incorrect management of the illness due to a lack of recognition of its clinical features. Literature shows that many patients would recover if they are taken to a health facility within a short time following exposure to organophosphates, followed by a correct diagnosis and clinical management [\[3, 8, 12-15\]](#).

After receiving findings of our investigation, the local police authorities conducted a criminal investigation and arrested one suspect. This fatal food-poisoning was caused by eating *bolingos* (fried rice balls) intentionally tainted with quinalphos. We recommended strict control of pesticide distribution and handling in the affected district as well as in the whole country, the national food and drug authority should audit the misuse of pesticides, re-orientation of clinicians on case presentations and management of organophosphate poisoning, and health education for school children to say no to food provided by other people.

Some of the limitations of this investigation was that blood samples of case patient A, B and D were not collected and analysed since the attending health workers did not suspect organophosphate poisoning in these patients. Also samples of the *bolingos* were not screened for presence of quinalphos since it was completely eaten by the four case patients.

Competing interests

The authors declare that they have no competing interests.

Declarations

Ethical approval

Clearance to conduct this investigation was obtained from ADS of the Centers for Disease Control and Prevention (CDC). The CGH HSR Tracking number is 2017-506.

Consent for publication

Consent for publication was obtained from a care taker of the case-patients and will be freely shared on request.

Availability of data and material

Data on the case-patients is available and will be shared on request by the corresponding author.

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Authors' contributions

ARA supervised and provided technical guidance in the follow up of the case-patients. PE and DNO were involved in following up of the case-patients. PE wrote the case report. All authors reviewed and approved the final manuscript.

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Table

Table 1: Clinical presentation of case-patients due to eating fried rice balls tainted with quinalphos in Sironko district, Uganda, 2017

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Table 1: Clinical presentation of case-patients due to eating fried rice balls tainted with quinalphos in Sironko district, Uganda, 2017

Clinical presentation	n (%)
Abdominal pain	4 (100)
Vomiting	3 (75)
Self-reported fever	2 (50)
Confusion	1 (25)
Convulsion	1 (25)
Loss of consciousness	1 (25)
Nasal bleeding	1 (25)