TOXICITY FROM INGESTION OF JATROPHA CURCAS ('SABOO DUM') SEEDS IN THAI CHILDREN

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Abstract. Jatropha curcas is widely cultivated in Thailand, the seeds of which yield high quality oil used for biodiesel production. Toxicity due to ingestion of Jatropha curcas has become more common among children due to the close proximity between cultivation and residential areas. We report 10 calls made over a 40-month period to the Siriraj Poison Control Center involving 75 children ages 2-14 years who experienced toxicity after ingesting various amounts of Jatropha beans. The amounts ingested, presenting symptoms, pertinent laboratory findings and their collective dispositions are reported. A brief review of recent published literature on toxicity due to ingestion of Jatropha curcas was also done.

Keywords: *Jatropha curcas* seeds, toxicity, children

INTRODUCTION

Jatropha curcas or 'saboo dum'(Thai: black soap) is an endogenous plant to parts of Asia, South America and Africa. It grows in tropical climates and is called by various names, depending on the geographic location. In Barbados, it is called 'the purging nut tree', while in India it is called Physic nut or Jungle Erandi (Barceloux, 2008). The tree produces a fruit that dries with seeds inside. The seeds have been used as abortificients, anthelmintics and purgatives. Analysis of the seeds reveals the latex inside the seeds contains a proteolytic enzyme, curcin, and an octapeptide, curcacycline A, which have shown anticomplement activity *in vitro*. Oil extracted from the seeds contains curcanoleic acid, which has an activity similar to ricin, a toxalbumin capable of causing hepatotoxicity in humans (Adam and Magzoub, 1975; Ahmed and Adam, 1979; Begg and Gaskin, 1994). The oil comprises 40% by weight of the seed, making the Jatropha bean desirable for biodiesel production (Berchmans and Hirata, 2008; Patil and Deng, 2009). In rural Thailand, Jatropha curcas is cultivated close to homes and schools. It produces a yellow fruit which matures into seed pods that fall to the ground and can be particularly enticing to curious children (Devappa *et al*, 2010). As a result, inadvertent and intentional overdoses have occurred in Thailand with increasing frequency over the past 3 years. With such exposures, the clinical concern centers around its

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ricin-like activity which is well known to cause hepatotoxicity in humans. We present here the largest number of cases of Jatropha poisoning ever reported in an attempt to shed light on the frequency and severity of Jatropha curcas poisoning.

MATERIALS AND METHODS

Records of calls reporting toxic ingestion of Jatropha beans from January 2006 to April 2009 from the Siriraj Poison Center in Bangkok, Thailand were reviewed. Information collected included the number of children involved in each call, the number of beans ingested by each child, the age of the child or children in years and the geographic location and presenting symptoms and signs. The protocol of the Siriraj Poison Center is to advise that patient be observed in the emergency department for 6-12 hours. Patients with persistent symptoms of nausea and vomiting are advised to be admitted for further observation and laboratory evaluations. This project received approval of the Siriraj Hospital Ethics Committee.

RESULTS

There were 10 calls made to Siriraj Poison Center over the study period, involving 75 patients. The youngest child was 2 years old and the oldest was 14. Six out of 10 cases involved more than 1 child, the largest being a group of 48 children who ingested the beans at school. The most common presenting symptoms were nausea, vomiting, diarrhea and abdominal pain. Twelve patients were admitted because of dehydration due to severe vomiting. Of these, one patient had a slightly elevated AST on presentation and 2 patients had abnormal liver enzymes at 24 and 48 hours after ingestion. The largest number of beans ingested was 20. All patients did well. Table 1 outlines the details of each call to the Siriraj Hospital Poison Center.

DISCUSSION

There have been 5 reports of toxicity due to Jatropha bean ingestion in the literature (Table 2). None were fatal. Because of its curcanoleic acid content which has been shown to produce severe gastrointestinal irritation in animals, symptoms of nausea, vomiting and diarrhea are common after ingestion (Stirpe *et al*, 1976; Rug and Ruppel 2000; Sudheer Pamidimarri *et al*, 2009). In more severe cases, such as one reported by Levin *et al* (2000), the gastrointestinal symptoms can last up to 72 hours. Diarrhea can be particularly severe, necessitating constant intravenous hydration (Levin *et al*, 2000). The other principal toxin in the seeds can be seen even after the oil has been extracted is a toxalbumin, curcin, which can inhibit protein synthesis (Barceloux, 2008). Curcin has been shown to be 1,000 times less potent than ricin, which may explain the relatively mild, transient liver enzyme elevations observed in our patients. In our series, only 3 cases had mildly-elevated liver enzymes, of which 2 cases had delayed elevations of 24 to 72 hours. Levin *et al* (2000) reports the delay can be up to 4 days.

The dose ingested is a major concern for physicians consulting the poison center. The children in our case series ingested up to 20 seeds with no permanent injury. There seemed to be no direct dose-response relationship between the number of seeds ingested and symptom severity. One interesting note is that in our report and in all 5 reports from the literature, Jatropha bean ingestion often

Table 1
Details of phone calls regarding Jatropha ingestion made to Siriraj Poison Center over a 40-month period.

Record number	No. of children involved	No. of seeds ingested	Age of patient (years)	Symptoms	Number admitted	Laboratory findings
1	6	11 to 20	5 to 6	Admitted all 6 patients	6	All children had normal AST/ALT levels.
2	48	0.5 to 10	6 to 12	Admitted 2 patients with severe nausea/vomiting	2	An 8-year-old child had a normal initial AST/ALT, but at 72-hours follow-up had an AST of 51 units/l. One week later at follow-up, the AST/ALT were normal. A10-year-old child had a normal initial AST/ALT, but at 24-hours follows-up had an AST of 48 units/l and an ALT of 39 units/l. Follow-up at 10 days showed normal AST/ALT levels.
3	1	10 to 20	6	Vomiting/abdominal pain	0	--------
4	8	6 to 20	2 to 10	Nausea, vomiting, diarrhea	1	1 child had an AST of 51units/l then normal at follow-up
5	3	2 to 3	3, 2, 9, 14	Nausea, abdominal pain	0	--------
6	3	Unknown	5 to 7	Vomiting	0	--------
7	1	10	9	Diarrhea, abdominal pain	1	Normal AST/ALT
7	1	3	9	Diarrhea, abdominal pain	1	Normal AST/ALT
8	1	6 to 7	6	Nausea, vomiting	0	--------
9	2	9	5,7	Abdominal pain	0	--------
10	1	10	5	Vomited 20 times	1	Normal AST/ALT

Table 2
Literature review of published Jatropha curcas toxicity cases.

Author	Number of patients involved	Number of seeds ingested	Presentation	Treatment (s)
Joubert *et al*, 1984	8	Unspecified	Nausea/vomiting	Intravenous hydration
Abdu-Aguye *et al*, 1986	2	Unspecified	Nausea/vomiting	Intravenous hydration and anti-emetic
Kulkarni *et al*, 2005	20	1-4 per child	Vomiting/diarrhea	Intravenous hydration and anti-emetic
Levin *et al*, 2000	2	> 10 per child	Obtunded/vomiting/diarrhea	Intravenous hydration Urine alkalinization
Rai and Lakhanpal, 2008	11	1-4 seeds per chid	Vomiting/diarrhea	Intravenous fluid, antiemetic, anti-spasmotic

involved multiple victims (Joubert *et al*, 1984; Abdu-Aguye *et al*, 1986; Levin *et al*, 2000; Kulkarni *et al*, 2005; Menezes *et al*, 2006; Rai and Lakhanpal, 2008). The fact the children concerned are older, school-aged children, suggests the ingestion is a result of curiosity and exploration rather than excessive hand-to-mouth activity normally observed with poisoning in younger children.

Because of its potential for systemtic toxicity, we recommend gastric lavage be performed when ingestion is recent (within one hour) and activated charcoal be given for all cases where time of ingestion is < 4 hours. Many patients may not be able to tolerate activated charcoal if they already have nausea and vomiting. Patient outcomes, both in our case series and in the reported literature, were favorable. No permanent sequelae or major morbidity were reported.

Although Jatropha curcas ingestion can cause severe gastrointestinal symptoms, it is not associated with major morbidity or mortality. However, school children, especially in rural areas, should be warned of the plant's potential for toxicity to discourage experimentation by tasting.

ACKNOWLEDGEMENTS

The authors would like to thank the staff of the Siriraj Hospital Poison Control Center for their help in gathering data for this manuscript.

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