Two cases of anticholinergic syndrome associated with consumption of bitter lupin flour

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Clinical records

Patient 1

A 73-year-old woman presented to a Western Australian metropolitan hospital in September 2007. She described having a dry mouth, lethargy and difficulty mobilising about an hour after eating two scones prepared with lupin flour. On arrival at hospital, her condition was much improved, and lethargy and dry mucous membranes were the only symptoms recorded. However, the treating doctor was not aware of the potential for anticholinergic effects, and may not have been looking for specific anticholinergic features. The patient was discharged several hours after presenting; her symptoms were attributed to a presumed allergic reaction.

Patient 2

A 66-year-old woman presented to the same hospital 3 days later in September 2007. This patient had developed symptoms 15 minutes after eating pancakes prepared with lupin flour. She reported more typical anticholinergic features of blurred vision, dry mouth, lethargy and light-headedness. On examination she was found to have a sinus tachycardia of 100 beats/min, mildly dilated pupils, dry mouth, blurred vision and a residual bladder volume of 590 mL after voiding, indicating a moderate degree of urinary retention. Anticholinergic syndrome after ingesting lupins was diagnosed. She was kept in hospital overnight and her symptoms had resolved by morning.

Recognition of a possible link

After Patient 2 was diagnosed with anticholinergic syndrome caused by eating lupins, consulting physicians recalled that Patient 1 had also reported lupin consumption. After reviewing the clinical notes from Patient 1, it was recognised that this patient also had anticholinergic symptoms and that the two cases might be linked.

Case investigation

The two patients were interviewed in regard to their food consumption before becoming ill. Patient 1 had purchased lupin flour from a specialty grocery chain and made scones with the flour. She remarked that the two scones she ate tasted very bitter. Patient 2 had purchased both lupin flour and lupin beans from a different store of the same grocery chain as that reported by Patient 1. She also remarked on the bitterness of the pancakes she had made with the flour. In addition, she reported soaking lupin beans she had purchased overnight, boiling them and eating one lupin bean, which tasted bitter.

The store identified by Patient 2 was inspected 2 days after she had bought the lupin flour. Questioning revealed that after the normal supply of sweet lupin flour was exhausted, a storeman had had 125 kg of bitter lupin beans (*Lupinus albus)* milled into flour. He was unaware of the danger associated with consuming untreated bitter lupins. It was this flour that was purchased and consumed by the two patients. The bitter lupin flour was distributed to a number of stores within the grocery chain. Further investigation revealed another two complaints of bitter-tasting bread made from the lupin flour, but no other cases of anticholinergic syndrome were reported.

Following the investigation, the proprietor removed the bitter lupin flour from sale. Samples of both bitter lupin beans and the bitter lupin flour were submitted for chemical analysis. The total alkaloid levels for the bitter lupin beans and flour were 1.92% and 2.01%, respectively. This was about 100 times the permissible alkaloid level for flour of 0.02%, or 200 mg/kg, as detailed in the Australia New Zealand Food Standards Code.[1] No standard exists in the code for allowable alkaloid levels in whole lupin beans. ◆

Lupins (*Lupinus* spp) are legumes, otherwise known as pulses. There are about 450 *Lupinus* species, with *L. angustifolius* and *L. albus* being the main species cultivated in Australia. While lupins have been predominantly used for animal feed, recent research has shown that eating them can provide health benefits for humans. The addition of sweet lupin flour to bread has been shown to reduce its glycaemic index, reduce energy intake and increase satiety of study participants compared with those who consumed standard white bread.[2,3] The addition of sweet lupin flour to sausages was shown to decrease fat intake and increase satiety in study participants when compared with those who consumed full-fat sausages.[4]

Adverse consequences of eating lupins can be divided into toxic and allergic reactions. Studies have identified both serological and clinical cross-reactivity between peanut and lupin, although lupin allergy can also occur without allergy to other legumes.[5,6] Lupins are separated into sweet varieties, which have an alkaloid content of approximately 130–150 mg/kg,[7] and bitter varieties, which need to undergo a debittering process to remove potent alkaloids before consumption (these are left with an alkaloid content of approximately 500 mg/kg after debittering).[7] The debittering process involves soaking beans in repeated changes of water. The alkaloids leach from the beans into the water, which is then discarded. Solvents can also be used for debittering.

Failure to remove, or incomplete removal of, alkaloids can result in lupin toxicity, manifesting as anticholinergic syndrome. Anticholinergic syndrome can also be caused by various drugs, including some antihistamines, antipsychotics, antispasmodics and antidepressants, as well as by eating some mushrooms and plants.[8,9] Plants known to cause anticholinergic syndrome when ingested include *Datura* spp (jimson weed, angel's trumpet), *Salvia divinorum* (diviner's sage), *Atropa belladonna* (deadly nightshade), *Hyoscyamus niger* (black henbane) and *Mandragora officinarum* (mandrake).[9,10]

Fatal cases of lupin poisoning have been reported, with the lethal dose calculated as about 30 mg/kg bodyweight.[7] Bitter lupins are commonly eaten by people of Mediterranean origin, and these traditional users are aware of the need to debitter the lupins before consumption. There are relatively few published reports of acute lupin toxicity overseas,[9-12] and only one in Australia,[13] which involved a Mediterranean woman who had eaten lupin beans that had not been sufficiently debittered.

In light of the increasing consumption of lupin products, we recommend that information be provided to food suppliers and

Lessons from practice

- Anticholinergic syndromes vary in their severity, but any combination of blurred vision; mydriasis; tachycardia; dry, flushed skin; dry mucous membranes; urinary retention; ileus; or delirium should raise suspicion of this diagnosis.
- Most anticholinergic syndromes are caused by medications used therapeutically or in the misuse setting. However, naturally occurring toxins from foods or plants should be considered where appropriate.
- Clinicians should question patients who present with symptoms of anticholinergic syndrome about their recent food consumption, particularly consumption of lupin-containing products.
- With increasing community interest in foods with a low glycaemic index, it is important that lupin flour suppliers understand the importance of distinguishing between sweet and bitter lupins in flour preparation. ◆

consumers about the dangers of selling and eating products containing bitter lupins that have not been appropriately pre-treated to remove toxic alkaloids. Clinicians should question patients who present with symptoms of anticholinergic syndrome about their recent food consumption, particularly consumption of lupin-containing products.

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Competing interests

None identified.

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