Bitter apricot kernels: to be consumed in strict moderation

Cases of bitter apricot kernel poisoning have been reported across Europe in recent years, leading to a warning being issued by the European Food Safety Authority (EFSA) [1].

This is because these kernels contain a significant amount of amygdalin, a cyanogenic glycoside, which releases highly toxic hydrocyanic acid (cyanide) during digestion.

Bitter apricot kernels have been on the market for a few years now, with claims of "anti-cancer" properties. While there is no scientific evidence of their value in curative or preventive cancer treatment, the popularity of these kernels can be measured on the Internet, where sites encourage their consumption in large quantities ranging from 10 kernels a day for prevention to 60 kernels a day for people suffering from cancer.

In cases of acute poisoning, because the brain and the heart are the organs most susceptible to cyanide, the victim very quickly presents with neurological and cardiac symptoms.

At low doses, cyanide poisoning can cause symptoms such as fever, headache, nausea, insomnia, lethargy, joint and muscle pain, and a drop in blood pressure. Poisoning from high doses can lead to convulsions, respiratory problems, decreased heart rate, loss of consciousness and even coma.

Cyanide has very high acute toxicity.

In 2016, EFSA established a safety level for single point exposure (acute reference dose or ARfD[1]) of 20 µg/kg body weight [1]. Based on these thresholds and the amount of amygdalin usually found in raw kernels, EFSA estimated the maximum quantity of kernels that would not exceed the ARfD to be around one to three per day for adults and half a small kernel a day for young children.

To better understand the situation in France regarding bitter apricot kernel poisoning, the French Poison Control Centres (CAPs) and ANSES examined the cases reported to the CAP network.

Exposure cases were extracted from the CAP National Database of Poisoning Cases (BNCI)[2] between 1 January 2012 and 11 October 2017.

Symptomatic cases were defined as relating to individuals who experienced one or more symptoms within 12 hours of when they last ingested kernels. Asymptomatic cases were also included to document ingested doses that did not result in any clinical signs.

An acute exposure case was defined as one resulting from a single dose and a chronic exposure case as one occurring in a regular consumer of bitter kernels.

To analyse cases according to the amount of cyanide ingested, the maximum amount of cyanide per kernel was estimated at 3.8 mg/g of apricot kernel [1].

A total of 154 cases were selected, including 86 women and 66 men with median ages of 42 and 15 years respectively. Among these 154 cases, 33 were symptomatic and 121 were asymptomatic at the time of the call to the CAP. In 12% of cases (n=18), the kernels were consumed for their "anti-cancer" properties, either by people with cancer (n=13) or for preventive purposes (n=5). As this information was not systematically provided in all the medical records, the frequency of this reason for consumption is undoubtedly higher.

[1] The acute reference dose (ARfD) is the maximum amount of active substance, expressed in mg/kg body weight, that can be ingested by the consumer for a short period, i.e. during a meal or a day, in food or drinking water, without an adverse effect on health.

[2] When a call is received by the toxicology emergency telephone hotline (RTU) of a Poison Control Centre, a medical record is created. This contains information on the person(s) exposed, the agents involved, the routes of exposure, and the symptoms, among other things. It is coded with an agent from the National Database on Products and Compositions (BNPC) and then recorded in the National Database of Poisoning Cases (BNCI). These two databases form the Poison Control Centres' Information System (SICAP).

Among the cases of acute exposure, the final outcome was known for 61 cases (40 remained asymptomatic and 21 were symptomatic). Table 1 shows the number of apricot kernels consumed according to the clinical situation.

The average number of kernels consumed was higher in symptomatic cases ($p<0.01$). The cumulative percentage of symptomatic cases increased with the number of kernels ingested, from 5% for less than five kernels to 80% for more than 50 kernels (see Table 2).

Table 1: Number of apricot kernels consumed in symptomatic and asymptomatic cases (n=61).

		Asymptomatic cases (n=40)	Symptomatic cases (n=21)	p
Number of apricot kernels consumed	Min	1.0	3.0	
	Max	50.0	90.0	
	Median	4.5	20.0	
	Average	9.8	27.2	<0.01

Table 2: Cumulative percentage of symptomatic cases according to the number of apricot kernels consumed at one time.

Number of kernels consumed (Estimated cyanide equivalent)**	Cumulative % of symptomatic cases
<5 (<9.5 mg)	5%
<10 (<19 mg)	12%
<20 (<38 mg)	19%
<30 (<57 mg)	26%
<50 (<95 mg)	30%
≥50 (≥95 mg)	80%

** For a maximum amount of cyanide estimated at 3.8mg/g of apricot kernel [1].

The reported symptoms, occurring in the first few hours after ingestion, were mainly neurological or neuropsychic, with dizziness, discomfort and headache, and other related symptoms such as digestive disorders, cardiac "palpitations" and transient respiratory discomfort.

Fifteen cases involved repeated consumption of apricot kernels. The people had contacted a CAP either because they had symptoms (7 cases) or because they had just become aware of the risk of cyanide poisoning (8 cases). In nine cases, consumption was for "anti-cancer" purposes. The duration of exposure was not always specified, while the amounts consumed ranged from one to 40 kernels a day, with a median of 10 kernels a day. Symptomatic cases showed signs of the same type as acute cases.

Among the 154 cases studied, symptoms were more pronounced in two cases. A 54-year-old woman presented with hypotension requiring hospital infusion after consuming 50 kernels in one day. An 87-year-old man suffered a heart attack after ingesting 40 kernels in one day.

These data collected by the CAPs, which only represent some of the cases in which medical treatment was sought, suggest that users should be alerted to the risks of serious poisoning incurred in the event of consumption of "recommended anti-cancer" doses. In this series of cases, while some of the symptoms observed could be explained by anxiety related to the discovery that there is a substance as toxic as cyanide in the food product consumed, the proportion of symptomatic cases was seen to increase with the quantity of kernels ingested, suggesting a dose-response relationship. No very serious cases were reported in these observations.

As envisaged in the EFSA analysis, in view of the uncertainties about the available thresholds for cyanide toxicity in humans, there is probably a margin of safety with respect to the published ARfD.

Given the lack of a scientific basis for data on the use of kernels from apricots and other species containing cyanogenic glycosides in the preventive or curative treatment of cancer, and the existence of serious cases reported in the scientific literature, it seems necessary to encourage consumers to exercise caution. Consumption of these kernels when added to enhance foods is still possible, and in this context, EFSA's recommendations guarantee the absence of health risks with a sufficient safety margin.

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Literature references:
[1] EFSA CONTAM Panel (EFSA Panel on Contaminants in the Food Chain), 2016. Scientific opinion on the acute health risks related to the presence of cyanogenic glycosides in raw apricot kernels and products derived from raw apricot kernels.