Patulin Fast Facts

What is Patulin?

Patulin is a mycotoxin that is produced by fungal species in the genera *Penicillium* and *Aspergillus* and is found in rotten or mouldy fruits, vegetables, cereals and other foods. However, major sources of contamination are apples and apple products.

The presence of blue mould (caused by *Penicillium expansum*) is a good indicator that Patulin is present in fruit. It usually infects fruit that is wounded or damaged, by insects, bruising or hail.

In apple varieties with an open calyx, the fungus may enter the core during early fruit development growing slowly within fruit tissues, not causing the fruit to rot, but still producing Patulin as it grows. If contaminated apples are used to make juice, Patulin can be carried through to the final product.

What's the Risk?

Patulin's presence in fruit has undesirable quality and safety effects.

While Patulin is a toxic metabolite, studies on an association to health risk to humans are limited. Some studies have reported that patulin is linked to nausea, vomiting and gastrointestinal disturbance.

There are limited studies that suggest Patulin can be carcinogenic in humans however, animal studies indicate immunotoxic and neurotoxic effects.[2]

The International Agency for Research on Cancer (IARC) evaluated the toxicity data and classified Patulin as "a compound for which there is not enough data to allow its classification".

The Joint FAO/WHO Expert Committee on Food Additives (JECFA) established a provisional maximum tolerable daily intake (PMTDI) of 0.4 µg per kg body weight (bw) in 1986*. If an average 2 year old girl weighs 12 kg, the maximum level of Patulin she can consume is 4.8 µg in one day.

*This PMTDI has been set on the basis that maximum intakes of patulin were estimated to be 0.2 µg/kg bw/day. It is highly likely intakes are currently much higher due to increase in recent food recalls of juices with exceeding levels of Patulin (>50 µg/kg).

[1] (2018) Mycotoxins. World Health Organisation. Mycotoxins (who.int)

[2] (1986) IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. Some Naturally Occurring and Synthetic Food Components, Furocoumarins and Ultraviolet Radiation. World Health Organisation. Vol 40.

Controlling Patulin

Patulin is mostly found in mould-damaged fruits, however, this damage can often exist internally in what appears to be a non-infected apple. It can also occur in bruised fruit after controlled atmosphere storage and exposure to ambient conditions both with and without core rot being present.

Washing of fruit or removal of mouldy tissue, immediately prior to pressing will not necessarily remove all the Patulin.

The Codex Alimentarius Code of Practice (CXP 50/2003) for the prevention and reduction of patulin contamination in apple juice and apple juice ingredients provides recommendations of Good Agricultural Practice (GAP) and Good Manufacturing Practices (GMP).

Thermal processing (flash pasteurisation) used by industry may kill the fungus, but it will not remove all patulin that is already present.

Other several post-harvest methods e.g., pasteurisation, enzymatic treatment, UV radiation, ozone and high hydrostatic pressure have been reported to effectively reduce patulin levels in juice products. However, some may degrade the nutritional composition or quality of the product.

Regulation in Australia

Australia does not have legislation that specifically regulates Patulin, but the Australia & New Zealand Food Standards Code does regulate contaminants and natural toxicants, including some mycotoxins (Standard 1.4.1). Noting where limits have not been set under Standard 1.4.1, manufacturers are expected to follow recommended practices based on GMP, to ensure food is safe and suitable for human consumption.

The manufacturer/distributor is responsible for managing food safety and suitability and must demonstrate how they manage food safety to ensure the food is safe and suitable for human consumption.

A manufacturer of apple juice (or user of apple juice) must be able to demonstrate how they manage the levels of Patulin i.e., validation data. Codex has set an action level for Patulin of 50 µg/kg (CXS 193-1995), which has been adopted by many countries across the world.

The Australian juice industry ensures Patulin does not exceed the Codex 50 µg/kg maximum level in apple juice by conducting periodic testing.

For More Information:

Codex Code of Practice

Australia New Zealand Food Standards Code

Codex General Standard

ABCL contact: lianna@ausbev.org