

A Review of Important Facts about Potato Glycoalkaloids

by Marita Cantwell

The principle glycoalkaloids in potatoes are a-solanine and a-chaconine. They contribute flavor to potatoes but at higher concentrations cause bitterness and are toxic to humans. Their natural function is probably to serve as stress metabolites or phytoalexins for the protection of the potato when attacked by insects, fungi, etc. Increases of solanine in the potato peel are closely associated with greening (synthesis of chlorophyll) of the peel. These biochemical processes are independent of each other, but are both activated by light.

For food safety purposes, an upper limit for glycoalkaloid content of 20 mg per 100 g of potato is generally accepted (100g is slightly less than 1/4 lb.). Concentrations of glycoalkaloids are 3 to 10 times greater in the peel than in the flesh. There is considerable variation in glycoalkaloid content among potato cultivars. The average content in the peel can vary from 3 to more than 100 mg/100g of peel. For peeled potatoes, the average content can vary from 0.10 to 4.50 mg/100g.

Storage conditions, especially light and temperature, are mainly responsible for increases in solanine during marketing. Although the glycoalkaloid content can increase in the dark, the rate of formation is only about 20% the rate of formation in light. The rate of synthesis of glycoalkaloids at 24°C(75°F) is about twice the rate at 7°C(45°F). Assuming a content of 20 mg/100g of fresh peel, and assuming that the potatoes are 1 foot below a single tube 30 watt fluorescent light (about 200 foot-candle or 18.5 lux light intensity) which would be a reasonable estimate of exposure in a well lighted retail display area, the solanine content would increase dramatically after 24 hours: the solanine content would double if the potatoes were at 7°C(45°F), be 4 times greater at 16 °C(60°F), and be 9 times greater in potatoes at 24°C(75°F) (reaching 180 mg/100g peel).



The potato alkaloids exert their toxic effects on the nervous system by interfering with the body's ability to regulate acetylcholine, a chemical responsible for conducting nerve impulses. Potato glycoalkaloids also act by general disruption of membranes, and symptoms of solanine toxicity include headache, nausea, fatigue, vomiting, abdominal pain and diarrhea. Cooking potatoes does not destroy the solanine. The glycoalkaloid α -chaconine is considered more toxic than α -solanine. Temporary gastrointestinal problems have been reported for some individuals eating potatoes that contained 3-10 mg/100g glycoalkaloids. Most of the laboratory studies on glycoalkaloids have been done on animals. The only comprehensive laboratory experiment on solanine toxicity to humans showed that 2 mg of glycoalkaloid per kg body weight produced classic symptoms of poisoning. An 80 kg person who ate 100 g of peels from the potatoes mentioned above with 180 mg solanine/100g peel would probably experience symptoms of solanine toxicity.

To avoid toxic levels of glycoalkaloids, potato cultivar selection is very important. However, improper postharvest handling conditions are the main cause of toxic levels in potatoes. To keep glycoalkaloid content low, store potatoes at lower temperatures, such as 7°C(45°F), keep potatoes away from light, market in opaque plastics films and paper bags, and rotate frequently on retail displays.

References:

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