PHYSIOLOGY

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Physiology

**Source of Toxin**

Glycoalkaloids are a naturally occurring toxin that acts as an enzyme inhibitor. They are a group of compounds of a nitrogen-containing element which is produced naturally in many cultivated Solanaceae family plant species. Plants having Glycoalkaloids includes tomatoes, eggplants, potatoes, and peppers. Potatoes are the major source and a Solanaceae plant member which, serve as major and cheap food source having good quality protein with energy (starch) produced in it, with 350 million ton of worldwide production. U.S. consumption of per capita potatoes is approximately 61 kg/year. Glycoalkaloids, naturally occurring toxin is present in potatoes during their growth and harvest times. Glycoalkaloids have a more severe and toxic effect on man as compared to other animals (Maharijaya & Vosman, 2015). The main reason for this toxic behavior is due to anticholinesterase action of the Glycoalkaloids human main nervous system and also it disrupts cell membranes causing adverse effects on the digestive system as well as other vital organs. We cannot conclude with surety the possible influence of Glycoalkaloids on teratogenicity multifactorial aspects. Possible safe levels for the intake of Glycoalkaloids are debatable with several guidelines shedding light on this aspect.

**Enzyme Inhibition**

An enzyme that is inhibited by Glycoalkaloids is Cholinesterase. AChE (Acetylcholinesterase) and BuChE(butyrylcholinesterase ) are two enzymes that are closely related and are found in humans. The main function of AChE is to terminate cholinergic transmission present in the central nervous system and at the neuromuscular junction. Different inhibitors target this enzyme that is vital for toxicology and medical therapy. Another naturally occurring inhibitor includes (SGAs) solanaceous glycoalkaloids the α-solanine & α-chaconine are the main SGAs in potatoes both which are steroidal alkaloid triglycosides of solanidine derived from cholesterol. SGAs have serious concerns regarding toxicity because from 5-10 thousand plant toxins, only they inhibit AChE & BuChE. Chlorophyll synthesis is the main reason behind the solanine increase in potato peel (Omayio, Abong & Okoth, 2016). Although both of these biochemical processes are not dependent, they are activated when exposing to light.

**Toxin Inhibition by Enzyme**

Acetylcholinesterase Inhibition

Effective inhibition of AChE rate of hydrolysis is produced by reversal agents such as edrophonium, pyridostigmine, and neostigmine. Within the range of plasma concentration vecuronium and atracurium also had AChE activity for IC50values. The glycoalkaloid poisoning symptoms resemble strongly with those that are produced by AChE inhibition.  This suggests that in extreme SGA poisoning cases, SGAs micromolar concentrations exist in serum, although serum test is to be reported from these individuals.

Butyrylcholinesterase Inhibition

Pancuronium, neostigmine, and vecuronium are the reversal agents and neuromuscular blockers induced substantial inhibition of BuChE at concentrations relevant clinically.

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**Toxin Effect on Humans**

Glychoalcholoids are toxic for human intake if taken in large quantities. Although glycoalkaloids use in small quantity is taken naturally they can pose health risks. Generally glycoalkaloid content accepted upper limit for food safety purposes is 20milligram per 100 grams of potato. Glycoalkaloids concentration in the peel is 3-10 times greater than in flesh.

Potato alkaloids harmful effect happens when they hinder the regulation of acetylcholine which affects the nervous system. Potato glycoalkaloids disrupt and cause symptoms such as headache, fatigue, vomiting, nausea, diarrhea, and abdominal pain. Problems such as temporary gastrointestinal were reported for individuals consuming potato having 10 mg per 100g of glycoalkaloids (CHU, 2015). In laboratories mostly the glycoalkaloids experimentation is done on animals. There is only one solanine toxicity laboratory experiment is carried on humans which shows that 2 mg glycoalkaloid/kg of body weight shows poisoning symptoms.

**Natural Role of Toxin**

Glychoalcholoids are present in selected plant species whose role is to protect the plant against certain pathogens and predators like bacteria, viruses, animals, and insects, etc. Flavoring in certain plants is because of the presence of glycoalkaloids. The role of glycoalkaloids in the plants helps them to avoid insects attack. They are also beneficial naturally resistant for both nematode and fungal resistance.

**References**

 CHU, J.(2015). *Toxic Glycoalkaloids in Potatoes*. (2019). *Cfs.gov.hk*. Retrieved 27 April 2019, from https://www.cfs.gov.hk/english/multimedia/multimedia\_pub/multimedia\_pub\_fsf\_112\_01.html

Maharijaya, A., & Vosman, B. (2015). Managing the Colorado potato beetle; the need for resistance breeding. *Euphytica*, *204*(3), 487-501.

Omayio, D. G., Abong, G. O., & Okoth, M. W. (2016). A review of occurrence of glycoalkaloids in potato and potato products. *Current Research in Nutrition and Food Science Journal*, *4*(3), 195-202.