



NATURAL TOXIN SUBSTANCES IN EVERYDAY FOOD

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ABSTRACT

Natural toxins are present in a wide variety of plants. Some of these plants are commonly consumed as food. These toxic substances when ingested in significant amount or when they are not processed appropriately can be potentially harmful to human health causing food poisoning. This study conducted by the Centre for Food Safety of the Food and Environmental Hygiene Department aimed to review natural toxins in food plants commonly consumed in Hong Kong and the measures that can be employed to prevent poisoning from consumption of these food plants. Laboratory study of two natural toxins, glycoalkaloids and cyanogenic glycosides, was carried out to determine the levels of these toxins in food plants commonly consumed in Hong Kong. The effects of preparation and cooking on the reduction of the toxin levels were also studied. Results showed that glycoalkaloid contents varied among the different types of the fresh potatoes tested which ranged from 26-88 mg/kg (average 56 mg/kg). This was within the normal range of glycoalkaloid contents in potatoes of 20 - 100 mg/kg, which JECFA considered that consumptions on a daily basis were not of concern. The highest concentrations of glycoalkaloids were found in potato sprouts. Cyanide was detected in bitter apricot seed, bamboo shoot, cassava, and flaxseed samples in their raw state at levels of 9.3 mg/kg to 330 mg/kg. Cyanide contents were found to be higher in bitter cassava than sweet cassava. Cyanide concentration was found to be highest at the tip portion of bamboo shoot, followed by the middle portion, then the base portion. Cutting cyanogenic food plants into small pieces and cooking them in boiling water reduced cyanide contents of the food commodities by over 90%. Dry heat could not reduce cyanide contents effectively and only reduced around 10% of the cyanide contents in flaxseeds following oven-heating for 15 minutes. Consumers should avoid buying or eating potatoes that show signs of sprouting, greening, physical damage or rotting since glycoalkaloids are not decomposed by cooking. Cutting the cyanogenic plants into smaller pieces and cooking thoroughly in boiling water help release toxic hydrogen cyanide before consumption. When the cooking method chosen is heating under dry-heat or at low moisture contents, limit the intake of the cyanogenic plants to only small amounts.

KEY WORDS: glycoalkaloids, cyanogenic



INTRODUCTION

Natural plant toxins may be present inherently in plants such as fruits and vegetables which are common food sources. They are usually metabolites produced by plants to defend themselves against various threats such as bacteria, fungi, insects and predators.¹ Natural toxins may also be present in food plants as a result of natural selection and new breeding methods that enhance these protective mechanisms. Poisonings induced by plant toxins have long been known through consumption of foods such as beans that are not fully cooked, some cultivars of potatoes, and ingestion of plants picked from the wild not intended for human consumption such as poisonous berries and mushrooms. Acute poisoning cases caused by plant toxins are sometimes underestimated due to the fact that the toxicity symptoms can be rather non-specific. In the past, acute poisoning from a high intake of glycoalkaloid, such as solanine, from potatoes has been mis-diagnosed as microbial food poisoning.¹

Laboratory Analysis

Laboratory analysis was carried out according to the AOAC Official Method 997.13.22 Ten potato tubers were peeled. The peel and flesh were ground and homogenised in liquid nitrogen. The homogeneous sample was extracted with dilute acetic acid, followed by purification by solid phase extraction 21 (SPE). Finally, α -solanine and α -chaconine were quantified by HPLC with ultraviolet detection at 202 nm. The limit of detection (LOD) was 10 mg/kg for both α -solanine and α -chaconine.

DISCUSSION

GLYCOALKALOIDS IN POTATOES

The levels of glycoalkaloids present in potatoes are determined by the particular variety or cultivar and are affected by the growing conditions. Glycoalkaloid contents (sum of α -solanine and α -chaconine) for the five lots of potatoes tested in this study ranged between 26 - 88 mg/kg. These values were within the normal glycoalkaloid levels of 20-100 mg/kg found in properly grown and handled potato tubers. JECFA considered that consumptions of potatoes within this range of glycoalkaloid contents on a daily basis were not of

ADVICE TO PUBLIC

Purchase

1. Avoid buying potatoes that show signs of sprouting, greening, physical damage or rotting. Storage
2. Remove potatoes from plastic bags and place them in a cool, dry, and dark place at home.

concern. The potatoes sampled from the market in this study were therefore safe for regular consumption.

CONCLUSION & RECOMMENDATIONS

Natural toxins are found widely in edible plants which are otherwise nutritious and beneficial to health. These food plants can be safely consumed if suitable measures are taken, such as careful selection, adequate processing and cooking, and limitation of intake. Natural toxins were detected in food plant samples obtained from the Hong Kong market for this study, namely glycoalkaloids in potatoes and cyanogenic glycosides in bitter apricot seeds, bamboo shoots, cassava and flaxseeds. Glycoalkaloid contents of the five different varieties of potatoes obtained from the Hong Kong market were within the level of 100 mg/kg at which JECFA considered not of concern for daily consumption. Glycoalkaloids were concentrated in the peels of the potatoes. The highest level was found in the potato sprouts. Higher cyanide contents were found in bitter cassava than sweet cassava. Cyanide concentration was found to be highest at the tip portion of bamboo shoot, followed by the middle portion, then the base portion. Cutting them into small pieces and cooking in boiling water reduced cyanide contents of food commodities by more than 90%. Dry heat could not reduce cyanide content effectively in flaxseeds, hence intake should be limited to small amounts. The amount of ingestion of food plants containing natural toxins that will cause food poisoning depends on many factors such as individual susceptibility, the cooking methods and the levels of toxin in the plant which may vary according to the species and geographical environment. The public is advised to take precautions in limiting the amount of intake and observing safety measures for toxin reduction prior to consumption especially for children and the elderly. For individuals with illness or with poor health conditions, they may wish to consult their doctors for further advice. The public is reminded to follow the health advice of maintaining a balanced and varied diet, including a wide variety of fresh fruits and vegetables, as they are nutritious and safe to eat after observing the above advice

3. Store only small amounts of potatoes at home.
4. Discard potatoes that show signs of sprouting, greening, physical damage or rotting.

Preparation and consumption Potatoes

1. Avoid eating potatoes that show signs of sprouting, greening, physical damage or rotting. Cyanogenic plants
2. Cutting the cyanogenic plants into smaller pieces and cook thoroughly in boiling water to



release toxic hydrogen cyanide before consumption helps reduce the level of the toxin. Since hydrogen cyanide is volatile, it is easily removed by open-lid cooking.

3. When the cooking method chosen is heating under dry-heat or at low moisture contents, limit the intake of the cyanogenic plants to only small amounts.

CONFLICT OF INTEREST- NIL

SOURCE OF FUNDING- Self

ETHICAL CLEARANCE- Not applicable

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