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植物血球凝集素中毒
Phytohaemagglutinin Poisoning

食物安全中心風險評估組
科學主任林漢基博士報告

Reported by Dr John LUM, Scientific Officer,
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豆類是世界上最常食用又多不同煮法的營養食物之一。然而，進食未經妥善處理的菜豆（例如四季豆、邊豆）及其他豆類（例如紅腰豆、白腰豆），或會因攝入天然存在的毒素 - 植物血球凝集素 - 而引致食物中毒。本文將簡介植物血球凝集素中毒。

Beans are one of the most versatile and commonly eaten nutritious foods throughout the world. However, the consumption of common beans (e.g. green beans, French beans) and other beans (e.g. red kidney beans, white kidney beans) without proper processing may cause food poisoning due to the naturally present toxin phytohaemagglutinin. This article will give a brief introduction on phytohaemagglutinin poisoning.

豆類中的植物血球凝集素毒素

凝集素廣泛存在於動植物，是一種會與糖結合的蛋白質，其凝集素在動植物中起着多種生物作用。然而，部分凝集素若含量過高，便可能引致中毒。已知有毒的凝集素包括在豆科植物的種籽（即豆類）含量相對高的植物血球凝集素。植物血球凝集素在植物有抵禦害蟲和病菌的作用。

植物血球凝集素一如其名，可凝集哺乳類動物的紅血球並干擾細胞代謝。此外，植物血球凝集素也是一種抗營養素，可妨礙人體吸收礦物質，特別是鈣、鐵、磷和鋅。

多種豆類都含有植物血球凝集素，但不同豆類的含量各異。紅腰豆（Phaseolus vulgaris）的植物血球凝集素含量最高；白腰豆(P. vulgaris 的另一品種)的毒素含量則約為紅腰豆的三分之一。此外，蠶豆（Vicia faba）的植物血球凝集素含量則僅為紅腰豆的百分之五至十。部分在香港經常食用的豆類，包括大豆、四季豆和豆角，均曾在其他地方引致植物血球凝集素中毒。由於不同品種豆類中的植物血球凝集素含量差異可以甚大，要預防食物中毒，所有豆類在進食前均應正確烹煮。

Phytohaemagglutinin Toxin in Beans

Lectins are widely occurring, sugar-binding proteins that perform a variety of biological functions in plants and animals. However, some of them may become toxic at high levels. Among the lectins known to have toxic effects is phytohaemagglutinin, which occurs at relatively high levels in the seeds of legumes (i.e. beans). Phytohaemagglutinin is involved in defence against plant pests and pathogens.

Phytohaemagglutinin, as its name implies, can agglutinate many mammalian red blood cells and interfere with cellular metabolism. Moreover, phytohaemagglutinin is an antinutrient, which can interfere with the absorption of minerals, particularly calcium, iron, phosphorus and zinc.

Phytohaemagglutinin is found in many beans, but the level varies among different species of beans. The concentration of phytohaemagglutinin is the highest in red kidney beans (Phaseolus vulgaris). White kidney beans, another variety of P. vulgaris, contain about one-third the amount of toxin as does the red variety. On the other hand, broad beans (Vicia faba) contain only 5% to 10% of the amount of phytohaemagglutinin that red kidney beans contain. Some commonly consumed beans in Hong Kong, including soya beans (大豆), green beans (四季豆) and yard-long bean (豆角) have been reported to cause phytohaemagglutinin poisoning in other places. To avoid food poisoning, all beans should be cooked properly before consumption since various cultivars of the same species of bean might have significantly varying levels of the phytohaemagglutinin toxin.

植物血球凝集素中毒的病徵

植物血球凝集素中毒的症狀包括嚴重胃痛、嘔吐及腹瀉。部分植物血球凝集素中毒的特徵摘述於下表：

Clinical Presentation of Phytohaemagglutinin Poisoning

Symptoms of phytohaemagglutinin poisoning include severe stomach-ache, vomiting and diarrhoea. Some of the characteristics of phytohaemagglutinin poisoning are summarised in the table below:

圖1: 部分香港經常食用而曾在其他地方引致植物血球凝集素中毒的豆類
Figure 1: Some commonly consumed beans in Hong Kong that have been reported to cause phytohaemagglutinin poisoning in other places

植物血球凝集素中毒的特徵	
死亡風險：	一般不會致命。
中毒劑量：	僅4至5粒未經烹煮的豆類便可引發症狀。
病發期：	一般在進食食物後1至3小時內開始出現腸胃不適，隨後在該段時間內出現腹瀉。
症狀：	腸胃不適，或有嚴重嘔吐。除嘔吐和腹瀉外，部分病人會出現腹痛。
病程：	一般在症狀出現後3至4小時內自行痊癒。部分病人可能需入院治理。
高危人士：	任何年齡或性別的人士均有可能中毒，嚴重程度則視乎毒素劑量而定。

減少毒素的方法

以水烹煮豆類可降低植物血球凝集素的毒性。相較已徹底煮熟的腰豆，未經烹煮的腰豆的植物血球凝集素含量可高出數以百倍。因此，只要徹底烹煮，食用含植物血球凝集素的豆類也無須擔心。不過，在海拔高的地方（水的沸點會下降）、採用低溫烹煮方法或在熱力傳送不均的情況下，烹煮含植物血球凝集素的食物時便須加倍小心。

要去除植物血球凝集素毒素，豆類必須以清水浸透和徹底烹煮（例如浸泡最少12小時後在沸水中徹底烹煮最少10分鐘）。有研究顯示，即使以攝氏85度烹煮豆類1小時，植物血球凝集素毒素仍然活躍，因此不應以低溫（如使用瓦煲或慢煮鍋）烹煮豆類，因為低溫烹煮或未能去除毒素。另一方面，市面上的罐頭豆由於經徹底加熱處理，故無須再烹煮已可安全食用。

植物血球凝集素的食用安全上限

食物安全規管機構，包括聯合國糧食及農業組織／世界衛生組織食物添加劑聯合專家委員會等，並未就植物血球凝集素進行評估，也未訂定用作風險評估的健康參考值。此外，食品法典委員會也未訂定相關的食物安全標準。然而，有報告指出進食僅4至5粒未經烹煮的豆類便可引起中毒症狀。最重要的是，用水烹煮豆類，可除去植物血球凝集素的毒性。消費者不應進食未經烹煮或沒有煮熟的豆類。

圖2: 如何預防因進食未經烹煮的豆類而引致植物血球凝集素食物中毒
Figure 2: How to prevent phytohaemagglutinin food poisoning from consuming raw beans

注意事項

- 多種豆類均含有天然毒素植物血球凝集素。進食未經烹煮的豆類可引致植物血球凝集素中毒。
- 用水烹煮豆類，可除去植物血球凝集素的毒性。豆類必須以清水浸透和徹底烹煮（攝氏100度）。由於低溫烹煮或不能除去毒素，因此不應以低溫（如使用瓦煲或慢煮鍋）烹煮豆類。
- 市面上的罐頭豆無須再烹煮已可安全食用。

給消費者及業界的建議

- 以清水浸透和徹底烹煮豆類，以去除植物血球凝集素毒素。
- 由於低溫烹煮或不能除去毒素，因此不應以低溫（如使用瓦煲或慢煮鍋）烹煮豆類。
- 切勿進食未經烹煮或沒有煮熟的豆類。

Characteristics of Phytohaemagglutinin Poisoning	
Mortality:	Generally not life-threatening.
Toxic dose:	As few as four or five raw beans can trigger symptoms.
Onset time:	Usually begins with extreme nausea and vomiting within 1 to 3 hours after ingestion of the product, with diarrhoea developing later within that timeframe.
Symptoms:	Upper and lower gastrointestinal illness. Vomiting may become severe. In addition to vomiting and diarrhoea, abdominal pain has been reported by some people.
Duration:	Recovery usually is rapid, within 3 to 4 hours after the onset of symptoms and spontaneous, although some cases have required hospitalisation.
Susceptible population:	All people, regardless of age or gender, appear to be equally susceptible. The severity is related to the dose ingested.

Methods of Toxin Reduction

Cooking with moist heat can reduce the toxicity of phytohaemagglutinin. When compared with fully cooked beans, raw kidney beans could have phytohaemagglutinin levels that are hundreds of times higher. Therefore, after sufficient cooking, the use of phytohaemagglutinin-containing beans as food in human diets is not a cause for concern. Special attention, however, should be paid when the phytohaemagglutinin-containing food is prepared at high altitudes where the boiling point is reduced, when low heat cooking methods are employed or in situations where heat transfer is uneven.

To destroy the phytohaemagglutinin toxin, beans should be soaked and boiled thoroughly in fresh water (e.g. soaked for at least 12 hours and then boiled vigorously for at least 10 minutes in water). Previous studies showed that the phytohaemagglutinin toxin remained active after the beans had been cooked even at 85°C for an hour. Therefore, beans should not be cooked at a low temperature, for example in a crock pot or slow cooker, since it may not destroy the toxin. On the other hand, commercially tinned/canned beans are safe to eat without further cooking as they have been subjected to thorough heat treatment.

Food Safety Limit on Phytohaemagglutinin

Phytohaemagglutinin has not been evaluated by food safety regulatory authorities including the Joint FAO/WHO Expert Committee on Food Additives (JECFA), and a health-based guidance value has not been established for risk assessment. Moreover, there is no relevant food safety standard established by Codex. Nevertheless, it has been reported that ingestion of as few as four or five raw beans can trigger symptoms. Crucially, cooking with moist heat can remove the toxicity of phytohaemagglutinin. Consumers should not eat raw or inadequately cooked beans.

Key Points to Note

- Many types of beans contain the natural toxin phytohaemagglutinin. Consumption of raw beans can cause phytohaemagglutinin poisoning.
- Cooking with moist heat can remove the toxicity of phytohaemagglutinin. Beans should be soaked and boiled thoroughly in fresh water (100°C). Beans should not be cooked at a low temperature, for example in a crock pot or slow cooker, since it may not destroy the toxin.
- Canned beans can be consumed safely without further cooking.

Advice to Consumers and Trade

- Soak and cook beans thoroughly to destroy the phytohaemagglutinin toxin.
- Beans should not be cooked at a low temperature, for example in a crock pot or slow cooker, since it may not destroy the toxin.
- Do not consume raw or inadequately cooked beans.

外遊提示：從彎曲菌感染爆發汲取的教訓

Reminding Travellers: Lessons from a *Campylobacter* Outbreak

食物安全中心風險評估組
科學主任莊梓傑博士報告

Reported by Dr. Ken CHONG, Scientific Officer,
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有媒體在十月報導，日本爆發一宗彎曲菌種引起的集體食物中毒事件，約900人受影響。涉事的食物是流水素麵，即是麵條從竹管流下，食客以筷子夾取流過的麵條。在沿竹管把麵條輸送下來的泉水中檢測出病原體。旅客到外國遊覽時可以享用當地美食，但應對任何食物安全的威脅保持小心謹慎。讓我們在本文中了解更多食物中的彎曲菌資訊和與旅遊相關的食物安全提示。

彎曲菌

彎曲菌常見於動物和部分人類的腸道內。人類疾病報告中最經常出現的彎曲菌種是空腸彎曲菌，其次是大腸彎曲菌。這些致病的彎曲菌種只能在攝氏30度以上生長，但能抵受較高的生長溫度，其最佳生長溫度為攝氏42度。儘管如此，相較於在室溫下貯存的食物，彎曲菌在冷藏於雪櫃內的食物中有較佳的存活率。此外，微氧環境，即減氧環境有利於大部分彎曲菌種生長。地球的大氣層約含21%氧，而3%至5%的氧氣濃度則最有利這些細菌生長。根據文獻記載，吃進少至500個彎曲菌細胞已足以令人患病。

彎曲菌引起的疾病

彎曲菌引起的腸胃不適可影響不同年齡組別的人士，當中以5歲以下的兒童和15至29歲的年輕成年人較常患上腸胃炎。潛伏期一般為2至5天。最常見的症狀為水狀腹瀉或出血性腹瀉、腹痛、發熱、頭痛、噁心及 / 或嘔吐。症狀一般持續2至10天，患者多數會自行痊癒，但部分人需要接受抗生素治療。在免疫力較弱人士可以出現致命的感染個案。在罕見的情況下，感染後可患上反應性關節炎和吉巴氏綜合症等長期疾病。吉巴氏綜合症是身體的免疫系統對神經的攻擊；吉巴氏綜合症患者可連續多個星期出現肌肉無力甚至癱瘓。

食物中的彎曲菌

彎曲菌在家禽、牛、豬、羊和狗等大多數溫血動物中廣泛存在。空腸彎曲菌有不同的宿主，但主要是家禽。大腸彎曲菌則主要在豬隻找到。未經徹底煮熟的肉類（特別是家禽）是彎曲菌其中一個來源。

其他來源包括未經巴士德消毒的奶類及製品、受污染的生的蔬果、受污染的水或受交叉污染的即食食物。動物糞便可污染湖泊及河流；全球有大量感染個案由飲用受污染的水引起。蔬果可通過接觸帶有動物糞便的泥土或水而受到污染。

旅遊期間作出精明的食物選擇

上文提及的感染個案追溯至受污染的泉水為彎曲菌的源頭。消費者在旅遊期間務須保持警覺，並應採取以下預防措施，以免染上經食物或水傳播的疾病：

- 在處理和進食食物前徹底清洗雙手。
- 選擇安全的飲料和食物，例如已煮沸的食水、瓶裝飲料、包裝飲料；不要食用生或未經徹底煮熟的肉類、家禽、海鮮及蛋。

Campylobacters

Campylobacters are commonly found in the intestinal tracts of animals and some humans. The most commonly reported *Campylobacter* species in human disease is *Campylobacter jejuni* followed by *Campylobacter coli*. These disease-causing *Campylobacter* species can only grow above 30°C but can tolerate higher growth temperature and 42°C is their optimum growth temperature. That said, *campylobacters* have been found to have better survival rates in food stored under refrigeration compared to food stored at room temperature. On the other hand, most *Campylobacter* species prefer a micro-aerobic atmosphere, i.e. reduced oxygen atmosphere. Oxygen comprises approximately 21% of the atmosphere, while these bacteria grow optimally at oxygen concentrations ranging from 3% to 5%. According to literature, consuming as few as 500 *Campylobacter* cells can cause illness.

Disease Caused by *Campylobacters*

Gastrointestinal illness caused by *campylobacters* can affect individuals of different age groups. Among them, children below the age of five and young adults aged 15 to 29 are more commonly detected with gastroenteritis. Incubation period is usually 2 to 5 days. The most common symptoms include watery diarrhoea or bloody diarrhoea, abdominal pain, fever, headache, nausea and/or vomiting. The symptoms generally last for 2 to 10 days. Infected people usually recover on their own while some need antibiotic treatment. A life-threatening infection may occur in people with weakened immunity. In rare cases, infection can be followed by long-term illnesses like reactive arthritis and Guillain-Barré syndrome (GBS). GBS is the attack of nerves by the body's immune system; people with GBS can experience muscle weakness or even paralysis for weeks.

Campylobacters in Foods

Campylobacters are widely distributed in most warm-blooded animals such as poultry, cattle, pigs, sheep and dogs. *C. jejuni* has a very varied reservoir but is predominantly associated with poultry. *C. coli* is predominantly found in pigs. Inadequately cooked meats (especially poultry) is one of the sources of *campylobacters*.

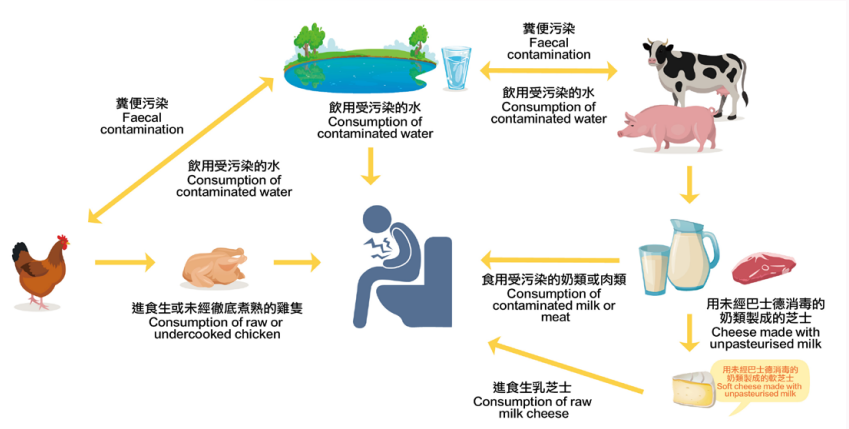

圖3: 彎曲菌通過食物和水傳播
Figure 3: Transmission of campylobacters via food and water

Other sources include unpasteurised milk and its products, contaminated raw fruits and vegetables, contaminated water or cross-contaminated ready-to-eat foods. Animal faeces can contaminate lakes and streams; the consumption of contaminated water is responsible for a number of outbreaks globally. Fruits and vegetables can be contaminated through contact with soil or water containing faeces from animals.

Smart Food Choice during Travel

The outbreak mentioned earlier was traced back to contaminated spring water as the source of *campylobacters*. Consumers should remain vigilant on food choice while travelling and take the following precautionary measures to prevent food- or water-borne illnesses:

- 不要飲用未經處理的水。
- 如對冰塊的來源或衞生情況有所懷疑，應避免在飲品中加進冰塊。
- 光顧衞生可靠的店鋪，切勿向環境衞生欠佳或未有妥善處理食物的街邊商販或其他食物銷售點購買食物。
- 避免食用已擺放於室温數小時的熟食或即食食物。
- 如自助餐、街市、食肆和街邊商販的食物並非熱存於攝氏60度以上或冷藏於攝氏4度或以下，便應避免食用。
- 生吃的蔬果應去皮，並且避免食用外皮破損的蔬果。

- Wash hands thoroughly before handling and consuming food.
- Choose safe beverages and food, e.g. boiled water, bottled drinks, packaged beverages; refrain from consuming raw or undercooked meat, poultry, seafood and eggs.
- Do not consume untreated water.
- Ice should be avoided in drinks if in doubt about its source or hygienic conditions.
- Buy food from hygienic and reliable premises; do not buy food from street vendors or other food outlets with poor environmental sanitation or seen with improper food handling.
- Avoid cooked food or ready-to-eat food that has been kept at room temperature for several hours.
- Avoid food at buffets, markets, restaurants and street vendors if they are not kept hot (above 60°C) or refrigerated (at or below 4°C).
- Peel fruits and vegetables if they are to be eaten raw. Avoid those with damaged skin.

減少食源性抗菌素耐藥性
Minimising Foodborne Antimicrobial Resistance

抗菌素耐藥性對預防和治療感染的成效造成威脅，因為細菌、病毒、真菌和寄生蟲不會再對抗生素等抗菌素產生反應。生態系統受抗微生物藥物污染，可導致抗菌素耐藥性細菌產生，抗菌素耐藥性細菌繼而沿食物鏈轉移至食用動物和農產品再感染人類。抗菌素耐藥性細菌可在屠宰的過程污染肉類，也可傳播至用受污染的水灌溉的蔬果。食物處理人員個人衞生欠佳及食物處理不當也可能傳播抗菌素耐藥性細菌。本地的監測結果顯示，部分食物樣本含有抗菌素耐藥性細菌。

從食物安全的角度來看，遵循食物安全五要點可以降低感染抗菌素耐藥性細菌和食源性疾病的風險，包括要徹底煮熟食物、保持良好個人及環境衞生和避免熟食或即食食物與生的食物交叉污染。嬰幼兒、孕婦、長者和免疫力較弱的人等高危人士應避免進食生及未煮熟的食物。

Antimicrobial Resistance (AMR) threatens effective infection prevention and treatment as bacteria, viruses, fungi and parasites no longer respond to antimicrobial agents like antibiotics. Contamination by antimicrobial pharmaceuticals to the ecosystem can lead to the emergence of AMR bacteria. AMR bacteria can then transfer to food animals and produces and then to humans along the food chain. AMR bacteria may contaminate meat during the slaughtering process, and spread to vegetables and fruits irrigated with contaminated water. Poor personal hygienie of food handers and improper food handling can also spread AMR bacteria. Local surveillance findings revealed that some food samples contained AMR bacteria.

From the aspect of food safety, following the Five Keys to Food Safety can reduce the risk of contracting AMR microorganisms and foodborne illnesses. This includes cooking food thoroughly, maintaining good personal and environmental hygiene and avoiding cross-contamination of cooked or ready-to-eat food by raw food. Susceptible populations like infants and young children, pregnant women, the elderly and people with weakened immunity should avoid consuming raw and undercooked food.

使用空氣炸鍋的食物安全提示
Food Safety Tips for Using Air Fryers

空氣炸鍋可以用很少油快速烹調出質感與油炸相近的菜式，因此是廣受歡迎的家庭電器。空氣炸鍋雖然名為炸鍋，但實際上是由風扇帶動熱空氣循環的小型對流式焗爐。

要預防食物中毒，應徹底煮熟食物，尤其是較大件的食物。切勿使空氣炸鍋超出負荷。烹煮時偶爾翻動食物。與任何高温乾熱烹煮方法一樣，氣炸容易產生丙烯酰胺和多環芳香族碳氫化合物等加工過程污染物。為減少加工過程污染物形成，避免以太高的温度長時間烹煮食物。在氣炸澱粉類食物時，把食物煮至呈金黃色形成即可。在氣炸食物前把脂肪切去和以水煮至半熟，也有助減少加工過程污染物。

消費者應保持均衡飲食，多吃蔬果，並控制膳食中脂肪及鹽的總量。

The air fryer is a popular home appliance as it is able to cook food quickly with little oil, with a resulting texture which resembles that produced by deep frying. Despite its name, it is actually a small convection oven with hot air circulated by a fan.

To prevent food poisoning, cook food thoroughly, especially for larger chunks of food. Do not overload air fryers. Turn the food occasionally when cooking. Like any high-temperature dry-heat cooking method, air frying is prone to formation of process contaminants like acrylamide and polycyclic aromatic hydrocarbons (PAHs). To minimise their formation, do not cook food at too high a temperature for too long. Aim for a golden-brown colour when air frying starchy food. Trimming the fat present and parboiling the food before air-frying it can also help to reduce the formation of process contaminants.

Consumers should maintain a balanced diet with plenty of vegetables and fruits and keep the total amount of fat and salt in check.

風險傳達工作一覽（二零二三年十月）
Summary of Risk Communication Work (October 2023)

事故/ 食物安全個案 *Incidents/ Food Safety Cases:* 260	公眾查詢 *Public Enquiries:* 171	業界查詢 *Trade Enquiries:* 258	食物投訴 *Food Complaints:* 455	給業界的快速警報 *Rapid Alerts to Trade:* 6
給消費者的食物警報 *Food Alerts to Consumers:* 4	懷疑食物中毒個案通報 *Suspected Food Poisoning Alerts:* 0	教育研討會/ 演講/ 講座/ 輔導 *Educational Seminars/ Lectures/ Talks/ Counselling:* 37	上載到食物安全中心網頁的新訊息 *New Messages Put on the CFS Website:* 58	