食物安全焦點
Food Safety Focus

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蘋果汁內的棒曲霉素
Patulin in Apple Juices

食物安全中心 風險評估組
科學主任馬嘉明女士報告

Reported by Ms. Janny MA, Scientific Officer, Risk Assessment Section, Centre for Food Safety

二零一七年八月，食物安全中心(中心)公布，一個由澳洲進口的"Cold Pressed Apple & Strawberry"飲品樣本被檢出含十億分之九十三的棒曲霉素，超出中心所採用的十億分之五十行動水平。本文將探討棒曲霉素的產生情況，以及控制蘋果汁在生產過程中受棒曲霉素污染所採取的措施。

棒曲霉素

棒曲霉素是由若干不同霉菌(例如青霉菌屬及曲霉菌屬)所產生的毒素。受損或發霉的水果，特別是蘋果，均可能含有棒曲霉素。一旦使用受污染的蘋果製成果汁，大量棒曲霉素很可能因而帶入最終產品。

有動物研究顯示，在短時間內攝取大量棒曲霉素會引致胃腸道血流量不正常地增加、出血及黏膜潰瘍。有研究亦顯示，棒曲霉素會令實驗動物的免疫系統及神經系統受損。至於棒曲霉素會否令人類致癌，國際癌症研究機構則表示，由於未有足夠證據證明會令人致癌，故未能作出有關評估。

規管情況及中心採取的行動

現時香港並無特定附屬法例規管食物中棒曲霉素的含量。不過，本地食品法例訂明，所有出售的食

圖1：蘋果汁生產的一般流程圖及控制蘋果汁中棒曲霉素含量的一些要點。

Figure 1: A general flowchart of apple juice production and some key points on controling the patulin levels.

In August 2017, the Centre for Food Safety (CFS) announced that a "Cold Pressed Apple & Strawberry" beverage sample imported from Australia was found to contain patulin at a level of 93 parts per billion (ppb), exceeding the action level of 50 ppb adopted by the CFS. This article discusses the occurrence of patulin and the measures to control its contamination in the production of apple juices.

Patulin

Patulin is a toxin produced by a number of different moulds such as *Penicillium* and *Aspergillus*. It can be found in damaged or mouldy fruits, particularly apples. If contaminated apples are used to make juices, high levels of patulin are likely to be carried through to the final product.

Animal studies have shown that exposure to high levels of patulin over a short period of time caused abnormal increased blood flow, bleeding and open sore in mucous membrane in gastrointestinal tract. Patulin has also been shown to cause adverse effects to the immunological and nervous systems in experimental animals. As for the ability of patulin to cause cancer to humans, the International Agency for Research on Cancer concluded that no evaluation could be made as there is inadequate evidence for carcinogenicity.

Regulatory Control and Actions Taken by the CFS

Currently, there is no specific legislation to regulate the level of patulin in food in Hong Kong. However, the local food law stipulates that all food for sale must be fit for human consumption. The CFS has adopted an action level at 50 ppb for patulin in apple juice and apple juice used as an ingredient in other

控制蘋果汁中棒曲霉素含量的一些要點

- 在受控制的環境下貯存蘋果；
- 減少蘋果受損；及
- 在生產過程中不使用外部及／或內部受損或發霉的蘋果。

Some key points to control patulin levels in apple juice

- Store apples under controlled conditions;
- Minimise physical damage; and
- Eliminate externally and/or internally damaged or mouldy apples from the production.

焦點個案
Incident in Focus

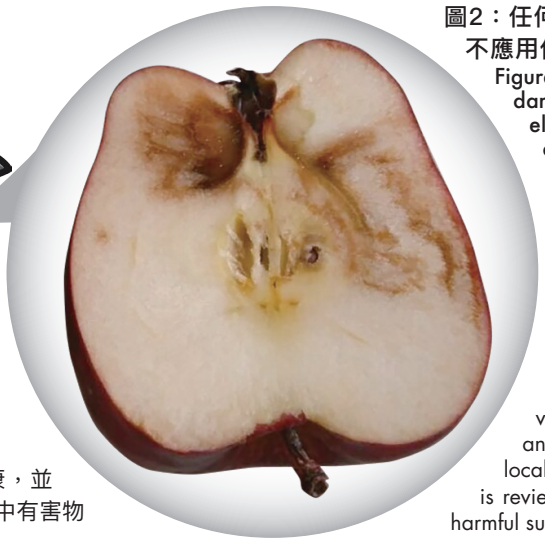

圖2：任何外部或內部受損或發霉的蘋果均不應用作生產蘋果汁。
Figure 2: Any externally or internally damaged or mouldy apples should be eliminated from the production of apple juices.

物必須適宜供人食用。中心參考食品法典委員會的標準，就蘋果汁及含蘋果汁成分的其他飲品的棒曲霉素含量訂定十億分之五十的行動水平。此外，一些其他司法管轄區，例如中國內地、歐洲委員會、美國及加拿大亦已就蘋果汁的棒曲霉素含量訂定標準 / 行動水平。為加強保障公眾健康，並促使本地標準與國際標準接軌，中心正檢討現行就食物中有害物質(包括棒曲霉素)的規管。

因應樣本的棒曲霉素含量超出行動水平，中心已知會涉事分銷商有關違規事項，而該分銷商已按中心的指令將有關批次的產品停售及下架，並展開回收。除了有關樣本外，中心亦對約20個其他蘋果汁及含蘋果汁成分的其他飲品樣本進行棒曲霉素檢測，結果令人滿意。中心將會繼續監察蘋果汁的棒曲霉素含量。

預防措施

蘋果汁的棒曲霉素含量可透過優良製造規範等良好作業規範來控制(見圖1)。食品法典委員會已制定一套《實務守則》(英文版本)，就預防蘋果汁及其他含蘋果汁成分飲品受棒曲霉素污染和減低其含量提供建議。

霉菌通常在溫暖潮濕的環境生長，故蘋果在採收後應貯存在受控制的環境下(例如保持冷藏)。由於任何瘀傷都有機會促使棒曲霉素的產生，故在處理採收後的蘋果時應盡量輕手小心，減少蘋果受損。

在壓擠蘋果前先去除發霉組織不一定能消除蘋果內所有已存在的棒曲霉素。這是因為部分棒曲霉素或已擴散至看似"健康"的組織。任何外部及/或內部受損或發霉的蘋果均不應用作生產蘋果汁(見圖2)。有報道指，棒曲霉素在花萼(花托)展開的蘋果品種的果核滋長的風險較大。這是由於真菌可能早在果實成長時已進入果核，因此，應定期在壓擠蘋果前檢視蘋果內部(切開蘋果作橫截面檢查)有否腐爛。

預先包裝的蘋果汁通常經加熱處理，例如採用巴士德消毒法把酶及某些微生物消滅，以延長產品的保質期。儘管巴士德消毒法一般可消滅霉菌，但卻不能消除已存在的棒曲霉素。

注意要點：

1. 棒曲霉素是由若干不同霉菌所產生的耐熱毒素。
2. 由受損或發霉的蘋果製造的蘋果汁可能含有大量棒曲霉素。
3. 遵循良好作業規範能控制蘋果汁的棒曲霉素含量。

給業界的意見

- 參考食品法典委員會的《實務守則》，採用優良製造規範生產蘋果汁。
- 切勿使用受損或發霉的蘋果製造果汁。在壓擠蘋果前，應切開蘋果作橫截面檢查，檢視蘋果內部有否受損或發霉。
- 在適當的環境下貯存蘋果及蘋果汁，避免滋生微生物和產生棒曲霉素。

給市民的意見

- 切勿食用受損或發霉的蘋果，或用作製造果汁。
- 鮮蘋果汁宜盡早喝掉。
- 按照製造商在標籤所提供的指示貯存預先包裝的蘋果汁。

beverages by making reference to the Codex Alimentarius Commission (Codex) standard. In addition, some other jurisdictions such as Mainland China, the European Commission, the United States and Canada have established standard/ action level for patulin in apple juices. With a view to better protecting public health and promoting harmonisation between local and international standards, the CFS is reviewing the existing regulatory control of harmful substances (including patulin) in food.

In response to the sample with patulin exceeding the action level, the CFS has informed the distributor concerned of the irregularity. The distributor has stopped sale and removed from shelves the affected batch of the product and initiated a recall according to the CFS' instructions. Apart from the concerned sample, some 20 other apple juices and apple juice used as an ingredient in other beverages samples were also tested for patulin with satisfactory results and the CFS will continue monitoring the level of patulin in apple juices.

Preventive Measures

Control of patulin levels in apple juice is achievable through best practice such as Good Manufacturing Practice (GMP) (see Figure 1). Codex has issued a set of Code of Practice, with recommendations to prevent and reduce patulin contamination in apple juice and apple juice ingredients in other beverages.

Since mould growth usually occurs in warm and humid environment, harvested apples should be stored under controlled conditions, e.g. keep refrigerated. Harvested apples should also be handled as gently as possible to minimise physical damages as any bruising will encourage patulin formation.

Removal of mouldy tissue of the apple immediately prior to pressing will not necessarily remove all the patulin present in the fruit as some patulin may have diffused into "healthy" looking tissue. Any externally and/or internally damaged or mouldy apples should be eliminated from the production of apple juices (see Figure 2). It has been reported that varieties with an open calyx (blossom end) are of greater risk for patulin development within the core as fungi may enter the core early during the fruits' development. Therefore, apples should be regularly examined for internal rots by cutting and cross-sectional examination before pressing.

It is noted that prepackaged apple juices are commonly heat-treated, e.g. by pasteurisation to ensure destruction of enzymes and certain microorganisms, to prolong product shelf-life. Even though pasteurisation will generally destroy mould, it cannot remove patulin which is already present.

Key Points to Note:

1. Patulin is a heat-stable toxin produced by a number of different moulds.
2. High level of patulin may be found in apple juices made with damaged or mouldy apples.
3. When following best practice, control of patulin level in apple juices is achievable.

Advice to the Trade

- Adopt GMP by making reference to the Codex Code of Practice in apple juice production.
- Do not use damaged or mouldy apples for juice manufacture. Before pressing, cut and cross-sectional examine the apples for the presence of internal damage or mould.
- Store apples and apple juices under proper conditions to prevent microbial development and patulin formation.

Advice to the Public

- Do not eat damaged or mouldy apples nor use them to make juices.
- Consume fresh apple juices as soon as possible.
- Store prepackaged apple juices in accordance with the manufacturer's instruction provided on label.

食物安全平台
Food Safety Platform

食物安全五要點與抗菌素耐藥性
Five Keys to Food Safety and Antimicrobial Resistance

食物安全中心風險傳達組
研究主任方朗茵博士報告

Reported by Dr. Fiona FONG, Research Officer,
Risk Communication Section, Centre for Food Safety

正如上期文章所述，抗菌素耐藥性是指微生物對藥物效力產生抵抗力，而耐藥微生物可在人類、動物、環境及食物中存在。世界衞生組織(世衞)表示，處理食物不當可令抗菌素耐藥性傳播。至於食物含有耐藥細菌的問題，防止人類因食物而引起感染，至關重要。食物安全中心(中心)一直致力推廣在整個食物製備及處理過程中保持良好個人及環境衞生的重要性。在有關食物中的抗菌素耐藥性的教育及宣傳工作上，中心負責推廣食物安全五要點。

何謂食物安全五要點?

食物安全五要點主要是由世衞制定。香港採用的食物安全五要點分別是：(1)“精明選擇”(選擇安全的原材料)；(2)“保持清潔”(保持雙手及用具清潔)；(3)“生熟分開”(分開生熟食物)；(4)“煮熟食物”(徹底煮熟食物)；以及(5)“安全溫度”(把食物存放於安全溫度)。這些要點是基於科學證據而訂出的簡單衞生訊息，人人均應多加了解和應用，以預防食源性疾病(不論致病菌是耐藥性與否)。

As mentioned in the last article, antimicrobial resistance (AMR) is the ability of microbes to resist the effects of drugs and AMR microbes may exist in people, animals, the environment and foods. The World Health Organization (WHO) states that inappropriate food handling encourages the spread of AMR. With regard to the already existence of AMR bacteria in foods, it is important to prevent humans from infected with these bacteria. The Centre for Food Safety (CFS) has all along been promoting the importance of good personal and environmental hygiene during all food preparation and handling processes. In connection with the education and publicity on AMR in food, the CFS promotes the Five Keys to Food Safety.

What are the Five Keys to Food Safety?

The Five Keys to Food Safety were primarily developed by the WHO. In Hong Kong, they are adopted as (1) "Choose" (choose safe raw materials), (2) "Clean" (keep hands and utensils clean), (3) "Separate" (separate raw and cooked food), (4) "Cook" (cook thoroughly), and (5) "Safe temperature" (keep food at safe temperature). They are simple health messages based on scientific evidence that each individual should know and practise in order to prevent foodborne diseases, regardless of whether the pathogens are AMR or non-AMR.

“食物安全五要點”有助市民預防食源性疾病。
Prevention of foodborne diseases by "Five Keys to Food Safety".

(1) “精明選擇” (選擇安全的原材料)

由於損壞的食品可能含有有害微生物，包括耐藥細菌，故消費者應光顧衞生環境良好及信譽可靠的店舖，並選擇新鮮及衞生的食物。

此外，消費者及販商不應從非法或有可疑的來源購買動物源性食材，因為用於這些食用動物的抗菌藥物受正式管制的機會不大，濫用抗菌藥物可令抗菌素耐藥性滋長及傳播。

(2) “保持清潔” (保持雙手及用具清潔)

由於雙手不潔可以傳播細菌，包括耐藥細菌，故食物處理人員應保持雙手清潔。特別是在處理食物前及如廁後，他們應用溫水及肥皂徹底清潔雙手。

此外，在衞生欠佳的環境準備食物，食物可能受耐藥細菌污染。有調查研究顯示，廚房不同地方的表面(例如工作枱面、水龍頭手柄及抹布)均發現耐藥細菌(例如抗藥性金黃葡萄球菌)。因此，廚房(包括用具)應保持清潔。

(3) “生熟分開” (分開生熟食物)

根據海外報告，生肉(例如雞肉及豬肉)被發現有耐藥細菌。這些細菌可以交叉污染方式傳至熟食。細菌可經直接傳播(例如當某種食品或其汁液接觸到另一種食品)或間接傳播(例如經雙手、砧板、抹布等傳播)。

為減低交叉污染的機會，生的食物應與熟食分開，可使用以不同顏色標籤標示的不同用具(包括砧板及刀具)，分別處理生的食物及即食熟食。

(1) “Choose” (Choose Safe Raw Materials)

Consumers should patronise reliable shops with good hygiene conditions and choose fresh and wholesome foods as damaged food products may contain harmful microorganisms including AMR bacteria.

In addition, consumers and traders should not purchase raw materials of animal origin from illegal or questionable sources because the use of antimicrobials in these food animals is unlikely under official control and the misuse of antimicrobials can accelerate the development and spread of AMR.

(2) “Clean” (Keep Hands and Utensils Clean)

Food handlers should keep hands clean as dirty hands may transmit bacteria including AMR bacteria. They should wash hands thoroughly with warm water and soap, especially before handling foods and after visiting toilet.

Besides, foods can become contaminated with AMR bacteria through unhygienic food preparation environment. Research studies showed that AMR bacteria (e.g. methicillin-resistant *Staphylococcus aureus*) were found on different surfaces in kitchen such as countertops, faucet handle and dish towel. Kitchen (including utensils) should therefore be kept clean.

(3) “Separate” (Separate Raw and Cooked Food)

According to overseas reports, AMR bacteria were isolated from raw meats such as chicken and pork. These bacteria can be transmitted to cooked foods by cross-contamination. They can be transmitted directly (e.g. when a food item or its juice comes into contact with another food item) or indirectly (e.g. through hands, cutting boards, towels, etc.).

To minimise cross-contamination, raw foods should be separated from cooked foods. Separate utensils (including cutting boards and knives) marked with labels of different colours can be used to handle raw foods and ready-to-eat cooked foods.

(4) "煮熟食物" (徹底煮熟食物)

生的食物一般含有細菌，但透過烹煮通常可消滅大部分細菌，包括耐藥細菌。食物應烹煮至中心溫度最少為攝氏75度。煮熟的肉及其肉汁不應呈紅色。湯羹及炆類食物應煮沸並維持最少一分鐘。

(5) "安全溫度" (把食物存放於安全溫度)

若烹煮後的食物安全措施稍有不足，即食熟食可能會被致病細菌(包括耐藥細菌)污染。倘若存放食物的溫度及時間不當，細菌可在食物中迅速大量繁殖，消費者進食後可能會患上食源性疾病。因此，食物在煮熟後宜立即進食，並避免放置於室溫下超過兩小時。熟食若放置於室溫下超過四小時，便應棄掉。煮熟的食物如非供即時進食，但將會仍在熱燙時食用，便應熱存於攝氏60度以上。另一方面，剩菜及容易腐壞的食物應盡快冷藏在攝氏4度或以下。

總的來說，預防人類感染耐藥細菌，至關重要。大致上，就預防及控制經食物傳播細菌所採用的原則，亦適用於預防及控制耐藥細菌傳播。徹底煮熟食物、處理食物期間遵守良好衞生規範、保持良好個人及環境衞生，對預防食源性疾病(包括由耐藥致病菌引起的食源性疾病)均極其重要。

(4) "Cook" (Cook Thoroughly)

Raw foods contain bacteria in general; however, thorough cooking can normally destroy most bacteria, including AMR bacteria. Foods should be cooked to a core temperature of at least 75°C. The cooked meat and its juices should not be red. Soups and stews should be brought to a boil and continue to boil for at least one minute.

(5) "Safe Temperature" (Keep Food at Safe Temperature)

Pathogenic bacteria, including AMR bacteria, may be introduced into the ready-to-eat cooked foods if there are subsequent lapses in food safety practices after cooking. They can multiply rapidly in foods as a result of time and temperature abuse to a level that can cause foodborne illness in consumers. It is therefore advisable to consume foods immediately after cooking and not to leave the cooked foods at room temperature for more than two hours. If the cooked foods have been held at room temperature for more than four hours, they should be discarded. For cooked foods that are not intended for immediate consumption but will be served hot, they should be kept at above 60°C prior to serving. On the other hand, leftovers and perishable foods should be refrigerated at or below 4°C promptly.

In gist, it is important to prevent humans from infection with AMR bacteria. Generally speaking, principles adopted to the prevention and control of spread of bacteria via foods are also applicable to the prevention and control of spread of AMR bacteria. Thorough cooking, good hygienic practices during food handling as well as maintaining good personal and environmental hygiene are all important to prevent foodborne diseases, including those caused by AMR pathogens.

食物事故點滴
Food Incident Highlight

本港售賣的沙律的微生物質素
Microbiological Quality of Locally Available Salads

食物安全中心(中心)在上月公布有關本港售賣的沙律的微生物質素的風險評估報告，涵蓋超過100個不經烹煮的蔬菜樣本。在所收集的樣本中，99%樣本沒有涉及微生物食物安全問題，只有一個樣本被檢出含有李斯特菌，其含量超過中心所制訂的《食品微生物含量指引》的規定。近年，海外研究／報告亦指出受致病菌污染的沙律會有潛在的健康風險。

沙律無須烹煮，故屬高危食品，有較大機會含有有害細菌。中心提醒業界須遵守優良製造規範，以控制相關的微生物危害。中心亦建議消費者應按製造商的指示處理食品。此外，易受感染的人士(特別是孕婦、兒童、長者及免疫力較弱的人)一般不應食用預製或預先包裝的沙律；如欲品嚐沙律，宜自行配製，並盡快食用。

Last month, the Centre for Food Safety (CFS) released the risk assessment report on microbiological quality of locally available salads covering over 100 samples composed primarily of raw vegetables. While 99% of the samples collected showed no microbiological food safety concern, one sample contained *Listeria monocytogenes* at a level exceeding the requirement in the CFS' Microbiological Guidelines for Food. In recent years, overseas studies/reports have also demonstrated the potential health risk arising from the contamination of salads with pathogens.

Salads are high risk foods as they have not been subjected to cooking, and are likely to harbour harmful bacteria. The CFS reminds traders to follow Good Manufacturing Practices for controlling associated microbial hazards. The CFS advises consumers to handle products in accordance with manufacturers' instructions. Moreover, susceptible groups (especially pregnant women, children, the elderly and people with low immunity) shall not eat pre-prepared or pre-packaged salads in general; if wanted, self-prepare and consume them as soon as possible.

喇沙中的產氣莢膜梭狀芽孢桿菌
Clostridium Perfingens in Laksa

食物安全中心(中心)在上月跟進食物投訴時，從一間食肆抽取一個喇沙樣本進行檢測。該樣本被檢出含產氣莢膜梭狀芽孢桿菌，其含量可能危害人們的健康。

烹煮可殺死生長中的產氣莢膜梭狀芽孢桿菌細胞，但其耐熱孢子或能存活。若熟食放置在攝氏20度至60度之間下足夠長的時間，孢子便會成長及產生新的細胞。市民吃下含有大量產氣莢膜梭狀芽孢桿菌細胞的食物，便會在腸道產生孢子及毒素，引致腹痛及腹瀉。大量配製的食物(例如食肆或機構食品服務商所配製的食物)需要較長的時間降溫，有利產氣莢膜梭狀芽孢桿菌繁殖。要預防食物中毒，預先煮熟的食物應妥善貯存並在進食前翻熱。

中心檢出喇沙樣本含產氣莢膜梭狀芽孢桿菌後，已指令有關食肆即時停止供應有問題食品及徹底清潔處所。中心亦已向食肆提供食物安全及衞生教育，並會繼續跟進事件。

Last month, the Centre for Food Safety (CFS) followed up on food complaints, collected a laksa sample from a restaurant for testing. The sample was found containing *Clostridium perfringens* (*C. perfringens*) at a level that was potentially hazardous to health.

Cooking kills the growing *C. perfringens* cells but the heat-resistant spores may survive. If cooked food is being held within 20°C–60°C for long enough time, the spores can grow and produce new cells. Intake of food containing large number of *C. perfringens* cells could lead to formation of spores and production of toxin in the intestine, resulting in abdominal pain and diarrhoea. Foods that are prepared in large quantities (e.g. those prepared by restaurants and institutional food services) require longer time for cooling that provides favourable conditions for the growth of *C. perfringens*. To prevent food poisoning, pre-cooked foods should be stored and reheated properly before consumption.

Upon the detection of *C. perfringens* in the laksa sample, the CFS instructed the restaurant to stop supplying the affected food immediately and carry out thorough cleaning of the premises. The CFS also provided health education on food safety and hygiene to the restaurant and will continue to follow up on the incident.

風險傳達工作一覽
Summary of Risk Communication Work

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