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米酵菌酸 – 不常見但可致命的毒素

Bongkrekkic Acid – Uncommon but Fatal Toxin in Certain Foods

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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2024年3月底，台灣衛生當局通報一宗在台北一家餐廳發生的食物中毒事故，導致34人食物中毒，兩人死亡。33人的臨床樣本檢出對米酵菌酸毒素呈陽性反應。據報，一名廚師的手檢出對該毒素呈陽性反應，顯示經該名廚師處理過的食物可能受到污染。懷疑涉事的食品包括河粉和粿條。在本文中，我們將加深對這種致命毒素的認識，並了解減低風險的方法。

In late March 2024, Taiwan's health authority reported a food poisoning outbreak at a restaurant in Taipei, resulting in 34 illnesses and two fatalities. Clinical specimens of 33 individuals were tested positive for the toxin bongkrekkic acid. It was reported that a chef's hands were tested positive for the toxin, suggesting that the food handled by the chef might have been contaminated. Suspected incriminated food included flat rice noodles and Char Kway Teow. In this article, we will get to know more about this fatal toxin and ways to reduce the risk.

米酵菌酸是什麼

米酵菌酸是一種耐熱毒素，由椰毒伯克氏菌產生，這種細菌在土壤及植物中無處不在，適合細菌生長的溫度範圍是攝氏30至37度，適合產生毒素的溫度範圍則是攝氏22至30度。最初通報的米酵菌酸中毒個案是因食用發酵粟米和以椰子為原料的食物而發生的。部分脂肪酸，特別是椰子和粟米內的脂肪酸能促進細菌生長和產生該毒素。

What is Bongkrekkic Acid

Bongkrekkic acid is a heat-stable toxin produced by the bacterium *Burkholderia gladioli* pathovar *cocovenenans* (*B. cocovenenans*), which is ubiquitous in soil and plants. The temperature range for bacterial growth is between 30 and 37°C and that for toxin production is between 22 and 30°C. Cases of bongkrekkic acid poisoning were originally reported as a result of consuming fermented corn and coconut-based products. Certain fatty acids, particularly those found in coconut and corn, can facilitate growth of the bacteria and production of the toxin.

主要受該毒素影響的器官有肝臟、腦部及腎臟，引發的症狀包括缺乏能量、眩暈、嗜睡、腹痛和嘔吐。發病的潛伏期由30分鐘至20小時不等，嚴重者可能在症狀出現後1至20小時內死亡。根據內地國家監測回顧數據，以往中毒個案的病發死亡率高達百分之六十。

Target organs of the toxin mainly include the liver, the brain and kidneys, causing symptoms including a lack of energy, dizziness, drowsiness, abdominal pain and vomiting. The incubation period for the illness is reported to be between 30 minutes and 12 hours. In severe cases, death can occur within 1 to 20 hours after the onset of symptoms. According to the review of national surveillance conducted in the Mainland, previous outbreaks have resulted in a high mortality rate of up to 60 percent.



圖1: 河粉與黑木耳

Figure 1: Flat rice noodles and black fungus



最近出現風險的食品

近年來，廣東和浙江曾爆發因食用某些浸泡過的菇菌和濕米粉引起的米酵菌酸中毒個案。這些個案涉及的菇菌為銀耳（雪耳）和黑木耳，涉及後者的個案較多。在這些個案中，菇菌大多浸泡了多於兩天，而一般相信這些菇菌若在正常情況下僅浸泡一段短時間，米酵菌酸是不大可能產生的。

濕澱粉製品或濕米粉製品（以大米為主要原料）是另一種在過去數年間涉及食物中毒個案的食品。同樣地，毒素產生的主要原因相信是長時間在室溫下存放，特別是存放時間超過24小時。在某些個案中，有人被發現違法使用一種名為脫氫醋酸鈉的防腐劑。這種防腐劑可抑制部分真菌及腐敗細菌的生長，但不能抑制椰毒伯克氏菌的生長，從而導致當麵食變壞時，在沒有味道變化的情況下存在細菌已經滋長的風險。

良好衛生規範為預防方法

當部分高風險食品置於室溫下時間過長，一般來說多於一天時，米酵菌酸便會產生。要預防這種情況，即使在烹煮前也需要保持這些高風險食品的時間和溫度控制得宜。若銀耳或黑木耳需要浸泡過夜，便應放進雪櫃內浸泡。濕米粉製品的保質期若多於一天，在運送、貯存和銷售過程中應在冷凍溫度下存放，這點在較暖的月份尤為重要，因為此時溫度有利椰毒伯克氏菌生長。此外，要減低與微生物交叉污染的風險，時刻保持良好食物衛生至關重要。

注意事項

1. 米酵菌酸是一種由椰毒伯克氏菌產生的耐熱毒素，最初通報的中毒個案是涉及進食發酵粟米和以椰子為原料食物。死亡率高的個案都涉及進食這些食品。
2. 近年曾發生進食浸泡菇菌和濕米粉引致的中毒個案，大多由在室溫下浸泡這些食品多於一天引起。
3. 要預防這種不常見但可致命的毒素，除了保持良好食物衛生，即使在烹煮之前也務必保持高風險食品的時間和溫度控制，以盡量減少因污染而可能存在的椰毒伯克氏菌的生長。

給業界的建議

- 運送濕米粉或類似食品到食物業處所時，要確保米粉蓋好或包好。
- 濕米粉或類似食品的保質期若多於一天，在運送、貯存和銷售過程中應在冷凍溫度下存放。
- 在室溫下運送時，確保運送時間不要超過預定的運送時間。此外，也可把所有非立即使用的存貨貯存在雪櫃內。

給市民的建議

- 濕米粉或類似食品，特別是散裝食品，應在購買當天進食或放進雪櫃內存放。
- 餐後如有剩下的濕米粉或類似食品，應盡快放進雪櫃內或棄掉。
- 棄掉氣味或味道異常的濕米粉或類似食品 and 經浸泡的菇菌。

Food Items with Emerging Risk

In recent years, outbreaks of bongkreikic acid poisoning due to the consumption of certain soaked mushrooms and wet rice noodles have been reported in Guangdong and Zhejiang. The mushrooms implicated in these outbreaks were silver ear fungus (snow fungus) and black fungus, with more cases involving the latter reported. Typically, these mushrooms were found to be soaked for more than two days in these outbreaks, while it was generally believed that bongkreikic acid would unlikely be formed when these mushrooms were soaked for only a short period of time under normal conditions.

Wet starch products or wet rice noodle products (using rice as the main raw material) is another type of food linked to outbreaks in the past few years. Similarly, the main cause of toxin production was believed to be prolonged storage at room temperature, specifically, storage for longer than 24 hours. In certain instances, the illegal use of a preservative called sodium dehydroacetate was uncovered. This preservative can inhibit the growth of some fungus and spoilage bacteria but not *B. cocovenenans*, resulting in a potential risk of bacterial growth without sensory changes when the noodles are spoiled.

Good Hygiene Practices for Prevention

Bongkreikic acid is produced in certain high-risk food items when they are left at room temperature for an extended period of time, typically more than a day. For prevention, it is important to maintain time and temperature control of these high-risk food items, even before cooking. For silver ear fungus or black fungus, they should be soaked under refrigeration, if it is necessary to soak them overnight. Wet rice noodle products should be kept at refrigeration temperature during transportation, storage, and sale, if the shelf life is more than one day. This becomes particularly important during warmer months when the temperature is favourable for the growth of *B. cocovenenans*. Additionally, to minimise the risk of contamination with microorganisms, it is crucial to practice good food hygiene at all times.

Key Points to Note

1. Bongkreikic acid is a heat-stable toxin produced by the bacterium *B. cocovenenans*, originally reported in fermented corn and coconut-based products. The consumption of these products has been associated with outbreaks that have a high fatality rate.
2. Outbreaks due to the consumption of black fungus and wet rice noodles have been reported in the past few years, which were typically caused by leaving these food items under ambient condition for more than a day.
3. To prevent this uncommon but fatal toxin, apart from maintaining good food hygiene, it is important to maintain time and temperature control of the high-risk food items, even before cooking, to minimise the growth of *B. cocovenenans* that may be present due to contamination.

Advice to the Trade

- Ensure that wet rice noodles or like products are properly covered or packaged when they are delivered to premises.
- Wet rice noodles or like products should be kept under refrigeration during transportation, storage and sale, if the shelf life is more than one day.
- For delivery at room temperature, make sure the delivery has not taken longer than the agreed transportation time. It is also advisable to store any stock that is not intended for immediate use in the refrigerator.

Advice to the Public

- Wet rice noodles or like products, especially those that are loosely packed, are recommended to be consumed within the day of purchasing or stored under refrigeration.
- If there are leftover wet rice noodles or like products from a meal, they should be refrigerated as soon as possible or discarded.
- Discard wet rice noodles or like products and soaked mushrooms that smell or taste abnormal.

認識超加工食品與相關的健康飲食方法

Understanding Ultra-processed Foods and the Related Healthy Eating Approaches

食物安全中心風險評估組
營養科主任梁喜媚女士報告

Reported by Ms. Amy Leung, Dietitian,
Risk Assessment Section, Centre for Food Safety

超加工食品是備受營養學家及醫護人員熱議的話題。本文將簡述此名詞的由來、聯合國糧食及農業組織（糧農組織）如何在出版物中應用此名詞，以及市民應如何因應有關資訊建立健康飲食習慣。

此名詞因何出現，又如何在聯合國糧食及農業組織刊物中引用

「超加工食品」一詞最早來自巴西聖保羅大學研究人員在2009年撰寫的一份學術研究報告。他們推出NOVA分類，即一種根據食品加工程度將食品分類的分類方法，旨在對食品加工及其對健康的影響加深認識，因為營養素被認為不足以反映食品加工對健康的影響。現時，糧農組織的刊物把食品分為四類。

- 第一類：未加工或最低加工食品 - 這些食品處於天然狀態或經過最低限度加工，例如製乾、冷藏和真空包裝等。示例包括新鮮水果、冷藏蔬菜及奶粉。
- 第二類：烹飪成分加工食品 - 這些食品是在家中或餐廳的廚房烹煮時使用的配料，在壓榨、精煉和碾磨等過程中產生。示例包括植物油、糖及鹽。
- 第三類：加工食品 - 這些食品由第一和第二類合併而成。示例包括以鹽水浸製的罐頭蔬菜、以油封存的罐頭魚及添加鹽或糖的果仁和種子。
- 第四類：超加工食品 - 這些食品通常在工業生產過程中製造。糖、油及脂肪和鹽常常混合在一起作為配料，用於超加工食品中。此外，具有超加工食品特點的配料為烹調時不常用的成分或各類別添加劑（如增味劑、色素及人造甜味劑）。示例包括碳酸飲品、薯片、曲奇、即食麵及冷藏薄餅。

某些衛生機構及組織有什麼觀點？

糧農組織的刊物檢視了有關超加工食品的研究，指出其營養品質與非傳染病存在關聯，其中包括高含量的游離或添加糖、飽和及反式脂肪、鈉和能量密度，以及低蛋白質、纖維和鉀含量。一些國際組織，如美國國立衛生研究院、世界衛生組織轄下的泛美衛生組織及期刊《刺針》等，都強調超加工食品對健康有不良影響，有的組織甚至視之為肥胖的成因之一。有關組織建議從膳食中減少或剔除這些食品，轉而選擇進食未加工、營養豐富的食物。

此外，2024年2月在《英國醫學雜誌》上發表的一項新近進行的大型研究發現，進食較大量超加工食品會增加多種健康問題（如心血管疾病、糖尿病、肥胖、焦慮及死亡）的風險。然而，研究人員承認是次研究有其局限，諸如針對不健康飲食習慣等干擾影響的調整尚未被考慮。再者，需進行更多研究，才能有助了解超加工食品如何影響健康。

市民應如何看待這種食品分類

市民在日常生活中應保持健康均衡的飲食，根據健康飲食金字塔的建議，適量及多元化進食各類食物，而不是完全避免進食超加工食品。保持健康均衡的飲食，較為重要的是考慮食物的營養價值而非單單考慮食品加工程度。事實上，現時衛生署推廣的健康飲食原則之一，就是減少進食高油、鹽、糖，以

The subject of ultra-processed food is a hot topic among nutritionists and health professionals. In this article, we will briefly go into the history of this term, how the Food and Agriculture Organization of the United Nations (FAO) used this term in their publication and how the public should adopt a healthy diet in light of the given information.

How this Term Arose and How it is Cited in the FAO Publication

The term "ultra-processed foods" first came from a paper written by researchers at the University of Sao Paulo in Brazil in 2009. They put forth the NOVA system, a food classifying system that groups foods according to the degree of processing, aiming to improve the understanding of food processing and its effects on health, as nutrients or foods are thought to be inadequate in capturing its impact. Currently, foods are categorized into four groups in the FAO publication.

- Group 1: Unprocessed or minimally processed foods - these foods are in their natural state or have undergone minimal processing such as drying, freezing and vacuum packaging. Examples include fresh fruit, frozen vegetables and powdered milk.
- Group 2: Processed culinary ingredients - these foods are ingredients used for cooking at home or in restaurant kitchens and are produced through processes such as pressing, refining and milling. Examples include vegetable oils, sugar and salt.
- Group 3: Processed foods - these food items are made by combining Group 1 with Group 2. Examples include canned vegetables in brine, tinned fish preserved in oil and salted or sugared nuts and seeds.
- Group 4: Ultra-processed foods - these products are typically made through industrial manufacturing processes. Sugar, oils and fats and salt are commonly used in ultra-processed foods and are often combined as ingredients. In addition, ingredients characteristic of ultra-processed foods are either food substances that are rarely used in culinary practices or classes of additives (such as flavour enhancers, colours and artificial sweeteners). Examples include carbonated soft drinks, potato chips, cookies, instant noodles and frozen pizzas.

How do some Health-related Authorities and Organisations View it?

The FAO publication reviewed studies on ultra-processed foods, and pointed out the association between their nutritional quality (including high levels of free or added sugar, saturated and trans fats, sodium and energy density, and low protein, fibre and potassium content) and non-communicable diseases. Some international organisations, such as the National Institutes of Health of the United States, Pan American Health Organization of the World Health Organization and the Lancet, emphasize the negative impact of ultra-processed foods on health and some even link them as a cause of obesity. They recommend reducing or eliminating these foods from the diet in favour of unprocessed, nutrient-packed options.

Furthermore, a recent large-scale study that was published in the British Medical Journal in February 2024 found that consuming a larger amount of ultra-processed foods increases the risk of a range of health problems such as cardiovascular disease, diabetes, obesity, anxiety and mortality. However, the researchers acknowledge that the study has its limitations. For example, confounder adjustments such as those for unhealthy dietary patterns have not been considered. Additionally, more studies are required to help to understand how ultra-processed foods affect health.

How the Public Should Approach Such Food Classification

Rather than trying to completely abstain from the consumption of ultra-processed foods, one should eat a healthy and balanced diet, which entails consuming a variety of food in the appropriate amounts as recommended by the Healthy Eating Food Pyramid. When adopting a healthy and balanced diet, it is more important to consider the nutritional quality of foods than the level of processing alone. In fact, one of the existing key messages promoted by the Department of Health in healthy eating principles is to reduce the intake of foods with high fat/oil, salt and sugar content as well as preserved and processed foods. Here are some easy and healthy eating tips demonstrating how to practise this principle:



圖2: 超加工食品的常見示例，如碳酸飲品、薯片、曲奇、即食麵及冷藏薄餅
Figure 2: Common examples of ultra-processed foods, such as carbonated soft drinks, potato chips, cookies, instant noodles, and frozen pizza

及經醃製和加工的食品。以下是一些簡單又健康的飲食建議，展示如何實踐這項原則：

1. 飲用清水，加入一片新鮮水果（如檸檬、橙）浸泡的水或清茶來代替碳酸飲品。
2. 以不加鹽及不經油炸的果仁和種子及水果（如新鮮蘋果切片、不添加糖的杏脯乾）為小食，而非薯片和曲奇。
3. 在家配製健康膳食。例如，加入新鮮或冷藏蔬菜及鮮肉或魚塊一起烹煮非油炸湯麵，而不是午餐肉或香腸即食麵。

儘管由於分類含糊而難以根據NOVA對食品進行分類，閱讀營養標籤仍可達到限制攝入此食品類別中高脂肪、高鹽及高糖食品的效果。因此，宜養成善用營養標籤來選擇合適的預先包裝食物的習慣，例如選擇糖和鹽含量較低的食物。需要個人化健康建議的人士，請諮詢營養師及醫護人員。

1. Replace carbonated soft drinks with water, water infused with a slice of fresh fruit (such as lemon, orange) or tea.
2. Snack on unsalted and non-fried nuts or seeds and fruit (such as fresh apple slices, dried and unsweetened apricots) instead of potato chips and cookies.
3. Prepare healthy meals at home. For example, instead of having instant noodles with luncheon meat or sausages, cook non-fried noodles in soup with fresh or frozen vegetables and fresh meat or fish slices.

Notwithstanding the difficulty in classifying foods according to the NOVA system due to the ambiguous nature of classification, limiting the intake of fatty, salty, or sugary products in this food class can still be achieved by reading nutrition labels. Therefore, do make it a habit to use nutrition labels for choosing appropriate prepackaged foods which are, for example, lower in sugar and salt content. For individuals who need personalised health advice, please consult a dietitian or healthcare professional.

鉀鹽作為食鹽代替品的角色

Role of Potassium Salt as a Replacement for Table Salt

攝取過量的鈉可能來自食鹽、佐料或加工食物；過量攝入鈉與高血壓、心臟病及中風有關聯。在本港，[鈉的主要攝入來源](#)是佐料及醬料，以及湯水等。世界衛生組織建議每日從膳食攝入的鹽少於5克（或2克鈉），以降低血壓。

要減少攝入鈉，消費者可善用營養標籤，找出鈉含量較低的食物。生產商應降低其食品的鈉含量。選項之一是氯化鉀（鉀鹽）代替部分食鹽（氯化鈉）。然而，患有某些疾病如腎病的人士，在選用減鈉鹽之前，應先徵詢醫護人員的意見。已添加氯化鉀的食品，應在產品上加以標示。

Excessive intake of sodium, which might come from the consumption of table salt, condiments or processed food, is associated with hypertension, heart diseases and stroke. Locally, [major source of sodium intake](#) is the consumption of condiments and sauces, soup, etc. The World Health Organization recommends a daily level of less than 5 g of salt (or 2 g sodium) from food to reduce blood pressure.

To reduce sodium intake, consumers can use nutrition labels to identify food with lower sodium levels. Manufacturers should reduce the level of sodium in their products. One of the options is to partially substitute table salt (sodium chloride, NaCl) with potassium chloride (KCl). However, individuals with certain medical conditions, like kidney disease, may seek medical advice before using KCl. Food products with added KCl should be labelled accordingly.

減低生三文魚的食物安全風險

Minimising the Food Safety Risk of Raw Salmon

最近，本港有媒體報導，有人在日本配製食物時，在一塊野生的生三文魚肉內發現活寄生蟲。根據有關報導，上述三文魚產品標示為非供生吃。三文魚產品，包括野生和在養殖場養殖的品種，均有可能受多種寄生蟲污染。進食帶有活寄生蟲的生或未煮熟食物，或會導致寄生蟲感染。

徹底煮熟食物是消滅寄生蟲的關鍵，加熱的環節則是有效的寄生蟲控制措施。若無法進行徹底加熱，可轉而採用冷藏的措施。把魚類冷藏於攝氏零下20度或以下七天或攝氏零下35度或以下約20小時，能殺死寄生蟲。市民應向持有有效食物業牌照並已申領適當簽批的食物業處所購買供生吃的三文魚。業界應採購附有出口國有關當局所發衛生證明書的三文魚。[高危人士](#)，包括長者和孕婦，都應避免進食生或未經徹底煮熟的三文魚。

Local media recently reported that a live parasite was found in a piece of wild-caught raw salmon during food preparation in Japan. The above salmon product was graded as not for raw consumption according to the report. Salmon products, including both the wild-caught species and those raised in fish farms, are susceptible to contamination with a wide range of parasites. Consuming raw or undercooked foods containing live parasites could potentially lead to parasitic infestation.

The key to eliminating parasites is to cook food thoroughly, and a heating step is an effective parasite control measure. If thorough heating cannot be done, a freezing step can be taken instead. Freezing fish at -20°C or below for seven days or at -35°C or below for about 20 hours can kill parasites. The public should purchase salmon for raw consumption from food premises with an appropriate endorsement on a food business licence. The trade should source salmon with valid health certificates issued by the relevant authorities of the exporting countries. [Susceptible populations like the elderly and the pregnant](#) should avoid eating raw and undercooked salmon.



風險傳達工作一覽（二零二四年三月）

Summary of Risk Communication Work (March 2024)

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給消費者的食物警報 Food Alerts to Consumers: 2	懷疑食物中毒個案通報 Suspected Food Poisoning Alerts: 1	教育研討會/ 演講/ 講座/ 輔導 Educational Seminars/ Lectures/ Talks/ Counselling: 52	上傳到食物安全中心網頁的新訊息 New Messages Put on the CFS Website: 60	