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Coffee: The Morning Routine for Many

食物安全中心風險評估組
科學主任游天頌先生報告

Reported by Mr. Arthur YAU, Scientific Officer
Risk Assessment Section, Centre for Food Safety

Recently, [local news media](#) reported that a company

claimed that more than half of 37 freshly prepared coffee drink samples they bought from chain stores locally contained "toxigants" and/or estrogen-like substances. In this article, we will share the knowledge on coffee, including contaminants that it might have and its potential health effects.

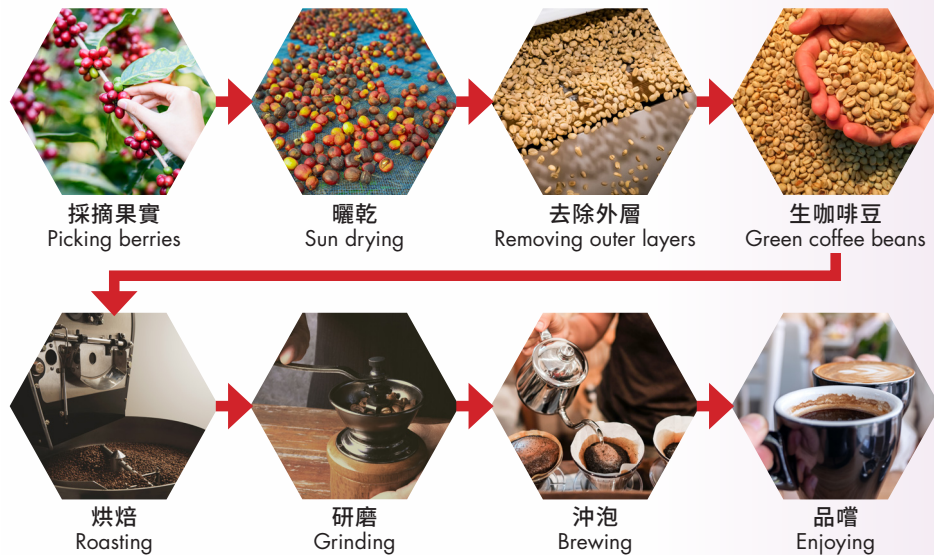


圖1：從農場到咖啡杯
Figure 1: Coffee: from farm to cup

最近有新聞報道，本地一間化驗所測試從連鎖咖啡店購買的37杯咖啡飲品樣本，當中超過一半含有「毒素」及/或類雌激素。在本文中，我們來了解一下這種普及的早餐飲品當中可能含有的污染物，以及可能對健康的影響。

何謂咖啡？

咖啡是以咖啡樹的種子調製而成的飲品，咖啡樹原產於非洲的熱帶地區，現廣泛種植於世界各地。咖啡樹的果實在成熟後經收割、曬乾及去皮的處理程序，種子便成為咖啡豆，然後進行烘焙、研磨及以水沖泡，便沏出一杯咖啡。咖啡豆還可進一步加工製成即溶咖啡粉、瓶裝飲品或其他咖啡產品。

飲用咖啡有益還是有損健康？

近年有[流行病學研究](#)顯示，飲用咖啡與減低某些慢性疾病的風險有關連，例如心血管病及二型糖尿病。此外，亦有不少證據顯示咖啡可能有預防子宮內膜癌及肝癌的效用。一般認為由於咖啡含有生物活性化合物，尤其是植物多酚，因此有促進健康的功效。

儘管以上證據顯示飲用咖啡對健康有益，但過度

What is Coffee?

Coffee is a drink prepared from the seeds of coffee plants which are native to tropical areas of Africa. It is now widely cultivated in many areas in the world. The berries of coffee plants are harvested when ripened, followed by sun drying and peeling. These processed seeds, known as coffee beans, are then roasted, ground and brewed with water to produce an infusion. It may also be further processed into instant coffee powder, bottled beverages or other coffee products.

Is Coffee Drinking Beneficial or Harmful to Health?

In recent years, [epidemiological studies](#) revealed that consumption of coffee is associated with decreased risk of certain chronic diseases, for example, cardiovascular diseases and type 2 diabetes. There is also consistent evidence that coffee can probably protect against endometrial cancer and liver cancer. These health-promoting effects are generally presumed to be due to bioactive compounds that coffee contains, particularly plant polyphenols.

Notwithstanding that there is evidence of health benefit,

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Incident in Focus

飲用咖啡可構成健康風險，這與其咖啡因含量有關。從一方面來看，飲用過量咖啡可令人手震、心悸、難以入睡、頭痛、暈眩及脫水。另一方面，習慣飲用咖啡的人士如突然停止飲用，會出現脫癮症狀，例如頭痛、疲勞、易怒及難以集中。食物安全中心(中心)與消費者委員會在二零一三年就本地食肆調製的咖啡和奶茶的咖啡因含量進行聯合研究，建議某些人士應限制咖啡因攝取量，例如孕婦及授乳婦女應限制咖啡因的攝取量於每日不超過200至300毫克，兒童則每日不應攝取超過每公斤體重2.5至5毫克的咖啡因。在參考數據顯示，每杯咖啡可能含有大約90至200毫克咖啡因，視乎調製方法而定。

有何因素影響咖啡中的咖啡因濃度？

咖啡的咖啡因含量可受多項因素影響。舉例來說，羅布斯塔品種咖啡的咖啡因含量多於阿拉比卡咖啡。按容積計算，特濃咖啡的咖啡因含量最高，其次是冷泡咖啡，而法式濾壓咖啡(濾壓式咖啡)及手沖咖啡(滴濾式咖啡)的咖啡因含量則最低。如水溫較高、沖泡時間較長及咖啡粉磨得較幼細，萃取的咖啡因也會較多。值得注意的是，進行脫咖啡因處理可除去咖啡豆所含約97%或以上咖啡因，但不能完全清除。

咖啡中的有毒物質

就癌症而言，國際癌症研究機構在二零一六年把飲用咖啡列為「在令人類患癌方面屬於未能界定類別」。該機構強調，這表示現有的科學數據無法得出咖啡是否致癌的結論。

在烘焙咖啡的過程中，可產生污染物丙烯酰胺，國際癌症研究機構將之歸類為可能令人類患癌。不過，中心的數據顯示咖啡的丙烯酰胺平均含量只有每公斤11微克，而本港成年人從咖啡攝入丙烯酰胺的分量佔總膳食攝入量的百分比只屬微不足道。

咖啡豆可能含有赭曲霉毒素A這種真菌毒素，原因是未有充分曬乾，滋生霉菌。然而，咖啡豆經烘焙後可去除分量不一的赭曲霉毒素A。中心的本地研究結果顯示，咖啡的赭曲霉毒素A平均含量只有每公斤0.03微克，而本港市民從各類食物攝入赭曲霉毒素A的分量也非常低，即使攝入量高的市民也僅佔健康參考值的9.2%。

注意事項

1. 未有足夠證據證明飲用咖啡會致癌。飲用咖啡或可減低某些慢性疾病的風險。
2. 咖啡含有咖啡因這種興奮劑，要注意攝入量。

給業界的建議

- 咖啡農及加工商應分別遵循優良務農規範及優良製造規範。

給消費者的建議

- 如要飲用咖啡，應適量飲用。
- 某些人士，例如孕婦及授乳婦女，如選擇飲用咖啡，應限制每日的飲用量。
- 注意咖啡飲品添加的糖分及能量，並參閱預先包裝產品上的營養標籤。

over-consumption of coffee may pose some health risks, especially related to its caffeine content. On the one hand, drinking too much coffee can lead to shaky hands, increased heart beat rate, difficulty in sleeping, headache, dizziness and dehydration. On the other hand, habitual drinkers who stop drinking abruptly would suffer from withdrawal symptoms like headache, fatigue, irritability and difficulty in concentrating. The Centre for Food Safety (CFS) had conducted a joint study with the Consumer Council on the caffeine content in coffee and milk tea prepared in local food premises in 2013, and advised that certain individuals like pregnant and lactating women should limit their caffeine intake to no more than 200 – 300 mg/day, while children should consume less than 2.5 – 5 mg/kg body weight/day. For reference, a cup of coffee may contain some 90 to 200 mg caffeine per serving depending on the preparation method.

What Factors Affect the Concentration of Caffeine in Coffee Infusions?

Many factors can affect the level of caffeine in coffee. For example, the Robusta variety of coffee contains more caffeine than the Arabica variety of coffee. On per volume basis, espresso has the highest level of caffeine, followed by cold brew, whereas French press (plunger) and pour over (filter) have the least amount. Higher water temperature, longer brew time and finer grind size of the coffee powder can also increase the efficiency of caffeine extraction. It is worth noting that decaffeination may remove about 97% or more, but not all, of the caffeine content in coffee beans.

Toxic Substances in Coffee

In terms of cancer, the International Agency for Research on Cancer (IARC) classified coffee drinking as 'unclassifiable as to its carcinogenicity to humans' in 2016. The IARC stressed that the classification means the existing scientific data do not establish a conclusion whether it causes cancer.

Coffee roasting can cause the formation of acrylamide, a process contaminant that is probably carcinogenic to humans as classified by the IARC. However, CFS data indicate that acrylamide level in coffee is only 11 µg/kg on average, and contribution of coffee to acrylamide intake to the diet of local adults is insignificant.

Coffee beans can also contain ochratoxin A, a fungal toxin, due to moulds formed from inadequate drying. However, coffee roasting is known to remove ochratoxin A in varying amounts. According to the local study conducted by the CFS, the average level of ochratoxin A in coffee is only 0.03 µg/kg, and the exposure level from all foods is very low, accounting for 9.2% of the health-based guidance value even for high consumers.

Key Points to Note

1. There is inadequate evidence for the carcinogenicity of coffee drinking. Coffee consumption may decrease risk of certain chronic diseases.
2. Consumers should pay attention to the consumed amount of caffeine, a stimulant in coffee.

Advice to the Trade

- Coffee farmers and processors should follow good farming practices and good manufacturing practices respectively.

Advice to Consumers

- If you drink coffee, drink it in moderation.
- If members of certain population sub-groups like pregnant and lactating women would like to have coffee, they should restrict their daily intake.
- Be aware of sugar and energy contents in drinks, and make reference to the nutrition label for prepackaged products.

黃曲霉毒素：最惡名昭彰的霉菌毒素

Aflatoxins: The Most Notorious Mycotoxins

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

霉菌毒素是某些霉菌(真菌)所產生的一組天然有毒化合物。目前已知的霉菌毒素有數百種之多，當中只有少數對動物及人類具有潛在毒性。就讓我們由毒性最強的黃曲霉毒素來開始這個霉菌毒素系列。

Mycotoxins are a group of naturally occurring toxic compounds produced by certain moulds (fungi). Currently, hundreds of different mycotoxins have been identified; only few of them have been associated with potential toxicity to animals and humans. Let's kick off this mycotoxin series with the most poisonous ones – aflatoxins.

食物中的黃曲霉毒素

黃曲霉毒素是由黃曲霉菌、寄生曲霉菌及相關種類的霉菌產生的一組耐熱化合物，在炎熱潮濕的地區特別多。在已知的14種或以上黃曲霉毒素中，黃曲霉毒素B₁、B₂、G₁及G₂對人類及動物健康的影響尤其值得關注。一般而言，黃曲霉毒素B₁最常見於受污染的食物，如食物中沒有發現黃曲霉毒素B₁，通常也不會發現黃曲霉毒素B₂、G₁及G₂。

Aflatoxins in Food

Aflatoxins are a family of heat-resistant compounds produced by the moulds *Aspergillus flavus*, *Aspergillus parasiticus* and related species, which are especially abundant in hot and humid areas. Among the 14 or more aflatoxins identified, aflatoxins B₁, B₂, G₁ and G₂ are of particular health concern in both humans and animals. In general, of these four aflatoxins, aflatoxin B₁ is the most frequently present in contaminated food; aflatoxin B₂, G₁ and G₂ are usually not reported in the absence of aflatoxin B₁.

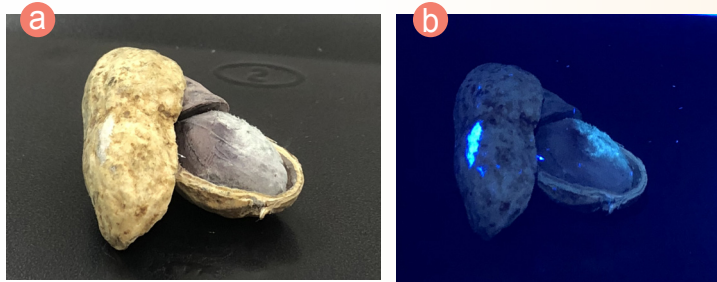


圖2: (a)發霉的花生及(b)在紫外光燈下的發霉花生發出螢光
Figure 2: (a) Mouldy peanut and (b) mouldy peanut under UV light with fluorescence observed

黃曲霉毒素趣談

- 黃曲霉毒素的英文名稱“aflatoxin”取自產生這種毒素“toxin”的黃曲霉菌“*Aspergillus flavus*”。
- 黃曲霉毒素在紫外光燈下會發出易辨的螢光；黃曲霉毒素B₁及B₂發出藍色螢光，而黃曲霉毒素G₁及G₂則發出綠色螢光。
- 下標數字₁及₂分別表示主要及次要的化合物。
- 黃曲霉毒素M₁是黃曲霉毒素B₁的代謝物，可在進食了受污染飼料的動物所生產的奶類及奶類產品(因此稱為M)中發現。

Fun Facts about Aflatoxins

- The term “aflatoxin” was derived from the mould, *Aspergillus flavus* that produced it i.e. a toxin.
- Aflatoxins are readily detected by a strong fluorescence in UV light; aflatoxins B₁ and B₂ produce blue fluorescence while aflatoxins G₁ and G₂ produce green fluorescence.
- The subscript numbers ₁ and ₂ indicate major and minor compounds respectively.
- Aflatoxin M₁ is the metabolite of aflatoxin B₁ that can occur in milk and milk products (hence the designation M) from animals consuming contaminated feed.

較易受黃曲霉毒素污染的食品例子有穀物(例如玉米、小麥及稻米)、油籽(例如花生)及木本堅果(例如開心果及杏仁)。

Food commodities such as cereals (e.g. maize, wheat and rice), oilseeds (e.g. peanut) and tree nuts (e.g. pistachio and almond) are susceptible to aflatoxin contamination.

對人類健康的不良影響

攝入大量黃曲霉毒素可引致急性中毒，即黃曲霉毒素中毒，可以致命，這通常是因為肝臟受損所致。

Adverse Health Effects in Humans

Ingesting large doses of aflatoxins can result in acute poisoning, i.e. aflatoxicosis, which could be deadly, usually through damage to the liver.

長期進食受黃曲霉毒素污染的食物也會對健康造成不良影響。國際癌症研究機構總結出，黃曲霉毒素具有基因毒性(破壞基因)，並令人類患癌(第1組物質)。黃曲霉毒素可引致肝癌，當中以黃曲霉毒素B₁的致癌作用最強。受乙型肝炎病毒感染的人士如同時攝入黃曲霉毒素，其患上肝癌的風險據報比非乙型肝炎病毒感染者高出約30倍。

Long-term consumption of food contaminated with aflatoxins can also result in adverse health effects. The International Agency for Research on Cancer concluded that aflatoxins are genotoxic (DNA-damaging) and carcinogenic to humans (Group 1). Aflatoxins can cause liver cancer and aflatoxin B₁ is among the most potent ones. The risk of liver cancer in individuals exposed to both aflatoxins and hepatitis B virus (HBV) infection is reported to be about 30 times higher than that in non-HBV infected individuals.

聯合國糧食及農業組織/世衛聯合食品添加劑專家委員會建議，應把黃曲霉毒素的攝入量減少至可合理做到的盡可能低水平。

The Joint Food and Agriculture Organization of the United Nations/WHO Expert Committee on Food Additives recommends that the intake of aflatoxins should be reduced to levels as low as reasonably possible.

預防措施

由於黃曲霉菌屬在大自然中無處不在，食物如在收割之前及/或之後受到污染，要完全消除當中的黃曲霉毒素是不可能的。除了炎熱和潮濕外，旱災、蟲害及貯存不當也可助長更多霉菌滋生，因而導致受污染食物含有大量黃曲霉毒素。

Preventive Measures

Since *Aspergillus* species are ubiquitous in nature, it is not possible to completely eliminate aflatoxins in food which has become contaminated before and/or after harvesting. Other than hot and humid conditions, drought stress,

因此，為了盡可能減低受黃曲霉毒素污染的風險，必須在整個食物鏈中實施有效的控制措施。這包括但不限於(1)遵循優良務農規範及優良製造規範；(2)丟棄有問題(例如發霉)、變色或損壞的食物，並不要用作生產食品的配料；(3)確保食物貯存於陰涼乾燥處，例如相對濕度低於70%、溫度低於攝氏10度的地方，可以抑制黃曲霉菌屬的生長及黃曲霉毒素的產生；以及(4)採用先入先出的方式存放食物。

如何減低黃曲霉毒素帶來的風險

保持均衡及多元化飲食，可避免因偏食而過量攝入黃曲霉毒素等污染物。

購買食物時應光顧可靠的店舖，妥善貯存食物(例如按照生產商的指示「貯存於陰涼乾燥處」)，並且不要長時間存放才食用。食物如有發霉或損壞跡象，便應棄掉。

下一期我們會繼續談談其他霉菌毒素。

insect damage and poor storage can also contribute to higher occurrence of moulds and consequently high levels of aflatoxins in contaminated food.

Therefore, it is important to implement effective control along the whole food chain to minimise the risk of aflatoxins contamination. Control measures include but are not limited to (1) observe good agricultural practices and good manufacturing practices; (2) discard defective (e.g. mouldy), discoloured or damaged food and do not use them as ingredients for food production; (3) ensure food is stored in cool and dry places e.g. relative humidity below 70%, temperatures below 10°C can stop *Aspergillus* species growth and aflatoxins production; and (4) rotate stocks on a first-in-first-out basis.

How Can We Minimise the Risk from Aflatoxins?

Maintaining a balanced and varied diet can avoid excessive exposure to contaminants including aflatoxins from a small range of food items.

Purchase food from reliable sources and store them properly (e.g. follow the manufacturer's instruction to 'keep in a cool and dry place') and not for extended periods of time before being used. Food that looks mouldy or damaged should be discarded.

We shall continue with other mycotoxins in the next issue.

食物事故點滴 Food Incident Highlight

避免進食發霉食物

發霉食物—吃還是不吃？有人說只要把食物發霉的部分去掉，就可安全食用。不過這是有風險的，因為實在難以區分和清除受影響的部分。

英國食物標準局指出，某些品種的霉菌可以產生對人類健康有不良影響的毒素，建議消費者不要吃明顯腐爛或帶有霉菌的食物。雖然除去霉菌及食品發霉的周圍部分有可能除去看不見的毒素，但不足以保證這樣做可將之全部清除。

為保障食物安全，一般來說，食物發霉便應丟棄，不要食用。容易腐壞或剩餘的食物應放入雪櫃，並盡快食用。

Mouldy food – to eat or not to eat? Some claim it is safe to eat mouldy food simply by scraping off the mouldy parts from the food. However, this can be risky, as it is indeed difficult to identify and clear the affected portion away.

According to the Food Standards Agency of the United Kingdom, some species of mould can produce toxins that have adverse health effects on humans, and consumers are advised not to eat food that is obviously rotten or containing mould. While it is possible that removing the mould and a significant amount of the surrounding product might remove any unseen toxins present, there is no guarantee that by doing so, all of them would be removed.

To ensure food safety, it is recommended in general not to consume but discard the mouldy food. Perishable food and leftovers should be refrigerated and consumed as soon as possible.

Avoid Consuming Mouldy Food

瓶裝水中的溴酸鹽

最近有瓶裝飲用水因驗出溴酸鹽含量超標而需予以回收，令人關注這種物質的安全問題。

當水進行消毒時，用作消毒的臭氧與水中天然存在的溴化物產生反應，便形成溴酸鹽。溴酸鹽的形成受多項因素影響，例如溴化物離子的濃度及水的酸鹼值、臭氧量及用於消毒的反應時間。攝入大量溴酸鹽可引致噁心、腹瀉、嘔吐及腹痛。情況嚴重者，腎臟及神經系統也會受到影響。世界衛生組織已把飲用水的溴酸鹽含量上限訂為每公升0.01毫克，如不超過此上限，則對健康構成威脅的可能性不大。

A recent recall of bottled drinking water due to the detection of bromate has drawn attention to safety issues of the substance.

Bromate is formed when ozone is used to disinfect water, reacting with naturally occurring bromide in water. The formation of bromate is influenced by a number of factors such as bromide ion concentration and pH value of the water, the amount of ozone and the reaction time used for disinfection. If taken in by large amounts, bromate can cause nausea, diarrhea, vomiting and abdominal pain. The kidney and nervous system also can be affected in severe cases. The World Health Organization has set a limit of 0.01 milligram/litre for bromate in drinking water and considers that a level within the limit is unlikely to pose any significant health threats.

Bromate in Bottled Water

風險傳達工作一覽 (二零一九年三月)

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