食物安全焦點
Food Safety Focus

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食物環境衞生署
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食物中的金屬污染物(第I部分)— 鉛與鎘

Metallic Contaminants in Food Part I – Lead and Cadmium

食物安全中心風險傳達組
科學主任游天頌先生報告

Reported by Arthur YAU, Scientific Officer,
Risk Communication Section, Centre for Food Safety

金屬普遍天然存在於環境中。金屬污染物可通過自然環境污染（例如火山活動、工業活動等）或在食物製作過程中受污染的食物進入食物供應鏈，因此食物中可能含有微量金屬污染物。

金屬污染物可通過多種途徑進入人體，膳食是當中重要的渠道。為保障公衆健康和促進國際食品貿易，多種食品已訂定了鉛(Pb)、鎘(Cd)及甲基汞(MeHg)等金屬污染物上限。聯合國架構下的國際組織——食品法典委員會，已經制定了多項與食物有關的指引和標準，包括為不同種類的食品訂定了重金屬的最高含量。在本港，《食物攙雜（金屬雜質含量）規例》（第132V章）訂定了金屬污染物的最高含量。這些最高含量對維持食物安全、保障市民免受攝入重金屬對健康帶來的潛在風險至關重要。最高含量是監察並規管食物中重金屬含量機制的基礎。

我們將在下文簡略探討從食物中攝取鉛和鎘引起的健康問題。

Metals are commonly found naturally in the environment. Metallic contaminants can enter the food supply chain due to pollution of the natural environment (e.g. volcanic activities, industrial activities) or contaminated food during the food production process, hence food may contain trace amounts of metallic contaminants.

Metallic contaminants can enter the human body through various pathways, and diet is one of the important routes. To protect public health and facilitate the international trade of food, like other jurisdictions, maximum levels (MLs) for metallic contaminants such as lead (Pb), cadmium (Cd) and methylmercury (MeHg) have been set for various types of foods that are of significance to the general public. The Codex Alimentarius Commission (Codex), an international organisation under the auspices of the United Nations, has developed many food-related guidelines and standards, including MLs of heavy metals across a wide range of food commodities. The Food Adulteration (Metallic Contamination) Regulations (Cap. 132V) set out the MLs for metallic contaminants in Hong Kong. These MLs are crucial for maintaining food safety and protecting the public from the potential health risks associated with heavy metal exposures. The MLs are the basis of the mechanisms that monitor and regulate the amounts of heavy metals in food

In the following sections, we will briefly discuss the health issues caused by dietary exposure to lead and cadmium.

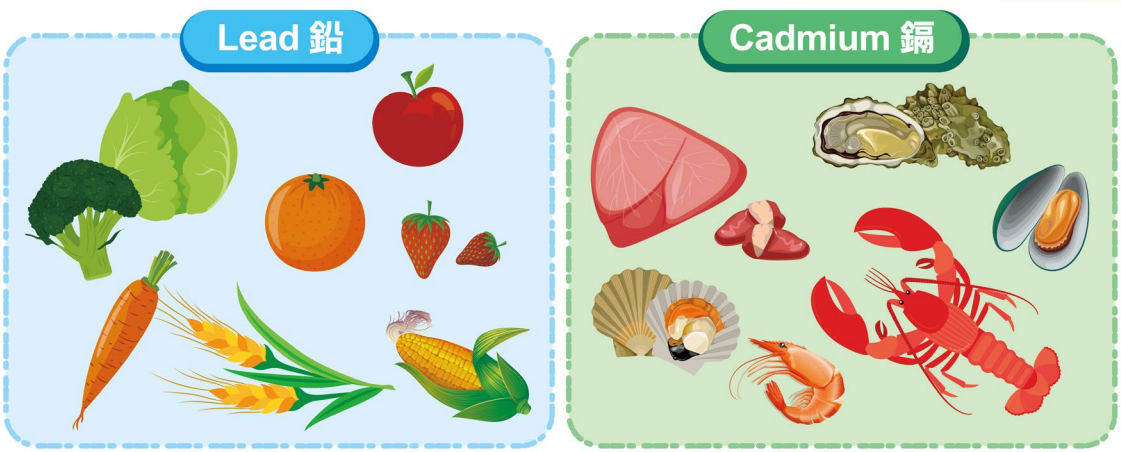

圖1: 有機會含有鎘和鉛的食品例子（鎘：哺乳動物（例如豬）的腎臟和肝臟、蠔、帶子、青口和甲殼類動物（例如蟹、龍蝦和蝦））（鉛：農作物）
Figure 1: Food that may contain cadmium and lead
(Cadmium: mammal kidneys and livers (e.g. pigs), oysters, scallops, mussels and crustaceans (e.g. crabs, lobsters and shrimps))
(Lead: crops)

鉛

攝取途徑

鉛自然存在於地殼中，也會在採礦、冶煉、製造電池、使用含鉛油漆及汽油和吸烟等人類活動中釋出。空氣中的鉛可能會沈降在農作物上，從而進入食物鏈。鉛在進食後會在胃腸道內吸收，然後積存在軟組織和骨骼。

毒性

攝取鉛可導致腦部發育遲緩，引致智力受損，對專注力、社交行爲及學習成效等表現造成不良影響，因此能對兒童造成嚴重後果。攝入鉛也可引致貧血、高血壓、腎臟受損、免疫系統毒性及生殖器官毒性。鉛被身體吸收後，會輸送到腦部、腎臟、肝臟及骨骼。鉛會存留在骨骼及牙齒，隨着時間的推移積聚。

嬰幼兒（特別是未滿五歲的）和孕婦較成年人容易受攝入的鉛影響，這是由於兒童按體重比例攝入量較大、吸入的塵埃較多、在胃腸道內的吸收率較高、血腦屏障發育未成熟、神經系統正在發育中，以及生命中有較長時間讓早期攝入鉛的影響浮現。孕婦攝入大量鉛，可導致流產、胎兒夭折、早產、體重過輕及輕度畸形。2010年，糧食及農業組織織 / 世界衞生組織聯合食物添加劑專家委員會認爲，無法就鉛訂定能保障健康的可容忍攝入量。

鎘

攝取途徑

鎘同樣自然存在於地殼中，會在火山活動、土壤侵蝕和河道運輸中釋出。鎘也可經採礦、金屬提煉、燃燒化石燃料、焚燒垃圾（特別含鎘的電池和塑膠）、生產磷肥、回收含鎘的廢鋼和電器及電子廢物，以及在舊礦場和廢物處置場地排水等人類活動釋出。鎘可以飄至遠離源頭，然後才以塵埃般隨着雨水降在地面。對非吸煙者來説，食物是鎘最普遍的攝入來源。使用含鎘量高飼料餵養的動物的腎臟和肝臟，以及某些品種的蠔、帶子、青口和甲殼類動物鎘含量最高。雖然蔬菜、穀物和澱粉根類的鎘含量較低，但由於這些食物在某些國家的消費量較高，因此從這些食物攝入鎘的分量佔攝入量的比重較大。此外，與非吸烟者相比，吸煙會令攝入量倍增。

毒性

長期攝入鎘會影響腎臟。鎘在腎臟積聚，或會影響腎小管功能。大量攝入鎘可影響鈣代謝，導致形成腎結石並影響骨骼。專家委員會已訂定鎘的暫定每月可容忍攝入量為每公斤體重25微克。從膳食攝入鎘引致急性中毒的可能性頗低。

下一期我們會討論從膳食攝入甲基汞，以及對健康的影響。

Lead

Sources and Exposures

Lead is naturally present in the Earth's crust and is also released through human activities such as mining, smelting, battery production, the use of leaded paint and gasoline and smoking. It can enter the food chain by atmospheric deposition of lead on crops. After ingestion, lead is absorbed through the gastrointestinal tract and deposited in soft tissues and bones.

Toxicity

Exposure to lead can have serious effects for children as it can impair brain development and lead to lower intelligence quotients (IQs), negatively affecting behaviours like attention span, social behaviour and educational attainment. Exposure to lead is also known to cause anaemia, hypertension, renal impairment, immunotoxicity and toxicity to the reproductive organs. Lead absorbed into the body is distributed to the brain, the liver, kidneys and bones. Lead is stored in bones and teeth, where it accumulates over time.

Infants and young children, particularly those under the age of five, and pregnant women are more susceptible to lead exposure than adults. This is due to the fact that children have a higher intake of lead per unit body weight, more dust ingestion, higher absorption in the gastrointestinal tract, a less developed blood-brain barrier, a developing nervous system and a longer life ahead of them for the effects of early lead exposure to manifest. Exposure to high levels of lead in pregnant women can lead to miscarriage, stillbirth, premature birth, low birth weight and minor malformations. The Joint FAO/WHO Expert Committee on Food Additives (JECFA) concluded in 2010 that no health-protective tolerable intake level for lead could be established.

Cadmium

Sources and Exposures

Cadmium also exists naturally in Earth's crust and is released through volcanic activities, erosions and transportation by river. It is also released through human activities like tobacco smoking, mining, metal refining, burning of fossil fuel, waste incineration (especially cadmium-containing batteries and plastics), manufacture of phosphate fertilizers, recycling of cadmium-containing steel scrap and electrical and electronic wastes and drainage from old mines and waste sites. Cadmium can travel a vast distance to regions far from the sources before it comes down as dust along with rain. For non-smokers, food is the most common source of cadmium exposure. The highest levels of cadmium can be found in the kidneys and livers of animals fed with cadmium-rich diets and in certain species of oysters, scallops, mussels and crustaceans. Although vegetables, cereals and starchy roots crops have lower cadmium levels, they nonetheless contribute to significant cadmium exposure in some countries due to their high consumption amount. Smoking also doubles the cadmium exposure compared with that of non-smokers.

Toxicity

Long-term exposure to cadmium would affect the kidneys, where its accumulation would impact renal tube functions. High intake of cadmium can affect calcium metabolism, leading to the formation of kidney stones and effects on bones. JECFA has established a provisional tolerable monthly intake (PTMI) of 25 μg per kg body weight for cadmium. Acute toxicity of cadmium due to dietary exposure is unlikely.

In the next issue, we will discuss the dietary exposure to methylmecury and its health effects.

認識食物中甜味劑的標準制訂

Understanding Standard Setting for Sweeteners in Food

食物安全中心風險評估組
科學主任黃詩雯女士報告

Reported by Ms. Sosanna WONG, Scientific Officer
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甜味劑按重量計，甜度遠比常用的天然砂糖為高。因此，在食物和飲品內加入極少量的甜味劑，便可達到預期的甜度，從而令最終食品的卡路里含量較低。本文是一系列以食物中甜味劑爲題的文章的概覽。

國際間甜味劑標準的制訂

為保障公眾健康，甜味劑須通過聯合國糧食及農業組織／世界衞生組織聯合食品添加劑聯合專家委員會（專家委員會）的嚴格評估。只有具有合理技術需要及經專家委員會定出每日可攝入量，或根據其他準則評定為安全的食物添加劑才會被納入食品法典委員會出版的《食品添加劑通用標準》（《通用標準》）。食品法典委員會《通用標準》所列的甜味劑均已經過專家委員會評估，評定為可在食物中合理使用。

食品法典委員會《通用標準》訂定准許食物添加劑（包括甜味劑）在指明食物類別／個別食物中的最高含量。為指明的食物訂定添加劑最高含量的做法，已獲內地、歐洲聯盟、澳洲、新西蘭和新加坡等多個司法管轄區所採用，此舉能確保從所有用途攝取的某種食物添加劑均不會影響健康。

此外，食品法典委員會《通用標準》還包含一份可按照優良製造規範原則適量在食物中使用的添加劑名單（即優良製造規範添加劑）。除專家委員會外，其他國家機構已對這些屬優良製造規範的添加劑進行風險評估，結論是在食物中使用這些添加劑並不會構成健康風險。

何為在食物中使用添加劑的優良製造規範原則？

根據食品法典委員會（食品法典委員會食物添加劑通用標準CXS 192-1995）的規定，使用食物添加劑時，必須符合「優良製造規範」的條件，包括：

a) 添加於食物內的添加劑分量，應限制在達到其預期效果所需的盡可能低的分量；

b) 因用於製造、加工處理或包裝某食物而成為該食物的成分的添加劑，如並非為對該食物本身發揮任何物理或其他技術作用而使用，其分量須減至合理可能的範圍內；及

c) 有關添加劑的品質須屬適當的食用級別，並以與食品成分相同方式配製和處理。

Sweeteners are food additives that are in general on a weight basis substantially sweeter than the common natural sugars. They can therefore be added to foods and beverages at considerably lower amounts to achieve the desired sweetness, leading to a lower caloric content in the final product. This article is the introduction of a series of articles on sweeteners in food.

Standard Setting for Sweeteners at the International Level

To protect public health, sweeteners have to undergo stringent evaluation by the Joint Food and Agriculture Organization (FAO) / World Health Organization (WHO) Expert Committee on Food Additives (JECFA). Only food additives with justified technological need that have been assigned an acceptable daily intake (ADI) or determined, on the basis of other criteria, to be safe by JECFA are included in the General Standard for Food Additives (GSFA) published by the Codex Alimentarius Commission (Codex). All sweeteners listed in Codex GSFA have been evaluated by JECFA and found acceptable for use in foods.

The Codex GSFA sets forth the maximum levels of permitted food additives, including sweeteners, in specified food categories/items. The approach of setting maximum levels of additives for specified foods is also adopted by various jurisdictions such as the Mainland, the European Union, Australia, New Zealand and Singapore. This ensures that the intake of a food additive from all its uses does not have health concern.

Besides, the Codex GSFA also contains a list of additives that are acceptable for use in foods in general when used in accordance with the good manufacturing practice (GMP) principles (i.e. GMP additives). Besides JECFA, other national authorities have conducted risk assessments on these GMP additives and concluded that the use of these additives in food does not represent a hazard to health.

What are Good Manufacturing Practice (GMP) principles in the use of food additives?

According to Codex (Codex General Standard for Food Additives CXS 192-1995), food additives shall be used under conditions of GMP, which include the following:

a) The quantity of the additive added to food shall be limited to the lowest possible level necessary to accomplish its desired effect;

b) The amount of the additive that becomes a component of food as a result of its use in the manufacturing, processing or packaging of a food and which is not intended to accomplish any physical, or other technical effect in the food itself, is reduced to the extent reasonably possible; and,

c) The additive is of appropriate food grade quality and is prepared and handled in the same way as a food ingredient.

為確保法典標準反映當前的科學知識及有助保障公眾健康，現行的標準（包括食品法典委員會《通用標準》所列載的標準）會按需要檢討和修訂，新的標準會由食品法典委員會建議及訂定。

本港情況

在香港，《食物內甜味劑規例》（第132U章）規管食物中的甜味劑。第132U章於1970年首次頒布，而上一次修訂則在2010年，新加入兩種已獲專家委員會確定為安全的經准許甜味劑——紐甜和甜菊醇糖。第132U章採用「准許列表」方式，訂明任何人不得售賣、託付、交付或輸入任何含有非附表內所指明的甜味劑並擬供人食用的食物。目前，第132U章列明了十種經准許的甜味劑，即醋磺內酯鉀、縮二氨酸基酰胺、天冬酰胺、天冬酰胺－醋磺內酯鹽、環己基氨基磺酸（和鈉、鉀、鈣鹽）、糖精（和鈉、鉀、鈣鹽）、三氯半乳蔗糖、索馬甜、紐甜和甜菊醇糖。

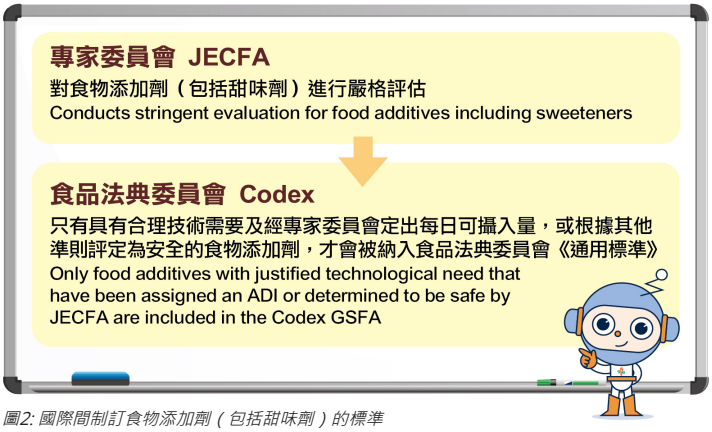

圖2: 國際間制訂食物添加劑（包括甜味劑）的標準
Figure 2: Standard setting for food additives including sweeteners at the international level

To ensure the Codex standards are consistent with current scientific knowledge and conducive to the protection of public health, existing standards including those in the Codex GSFA will be reviewed and amended as necessary and new standards will be proposed and set by Codex.

The Local Situation

In Hong Kong, the regulation of sweeteners in food is governed by the Sweeteners in Food Regulations (Cap. 132U). First enacted in 1970, Cap. 132U was last amended in 2010 to include two new permitted sweeteners - neotame and steviol glycosides - both deemed safe by JECFA. By adopting a "positive list" approach, Cap. 132U stipulates that no person shall sell, consign or deliver or import any food intended for human consumption containing any sweetener which is not specified in the Schedule. Currently, there are ten permitted sweeteners listed under Cap. 132U, namely acesulfame potassium, alitame, aspartame, aspartame-acesulfame salt, cyclamic acid (and sodium, potassium, calcium salts), saccharin (and sodium, potassium, calcium salts), sucralose, thaumatin, neotame, and steviol glycosides.

為了與國際規管食物中甜味劑的發展保持一致，食物安全中心已就法例對甜味劑的規管開始檢討工作。在檢討第132U章內各種甜味劑食物組合時，除了參考食品法典委員會最新的《通用標準》，亦會考慮多項相關因素，包括本港的食物消費模式及飲食習慣、不同司法管轄區所採用的相關標準（例如內地及歐洲聯盟），以及風險評估結果。

是次檢討旨在加强保障消費者，同時促使本地和國際食物安全標準接軌，最終能促進國際食品貿易，向食物業提供指標，確保食品可供消費者安全食用。

To align with the latest international developments on the regulation of sweeteners in food, the Centre for Food Safety (CFS) has commenced the work to review the regulatory control of sweeteners. When reviewing the sweeteners for various food pairs under Cap. 132U, besides making reference to the latest Codex GSFA, various relevant factors will be taken into account including the local food consumption pattern and dietary practice, relevant standards adopted by various jurisdictions (e.g. the Mainland and the European Union), and results of risk assessments conducted.

The review exercise aims to enhance protection for consumers while harmonising local and international food safety standards. Ultimately, this alignment would facilitate international trade and provide a benchmark for the food trade, ensuring that their products remain safe for consumers.

泡菜中的諾如病毒
Norovirus in Kimchi

南韓於7月發生一宗與進食受諾如病毒污染泡菜相關的食物中毒事故，涉及 1 000名患者。其後，涉事公司所有食品的生產、分銷及銷售均被暫停。

諾如病毒是世界上引起急性腸胃炎爆發及零星個案最常見的病毒，可經由糞口途徑，通過受糞便污染的食物和水傳播。此外，人與人接觸、接觸受污染的物件，以及噴沫亦是其他主要傳播途徑。因諾如病毒而食物中毒的患者可能會出現噁心、嘔吐、腹瀉和腹絞痛等病徵。

要減低諾如病毒的食物安全風險，市民應保持良好的個人和環境衞生。如廁後、處理食物前及進食前，用梘液及清水徹底洗淨雙手。業界應提醒出現腸胃徵狀的食物處理人員，要停止處理食物。感染諾如病毒的食物處理人員須於症狀消失至少48小時後才可重回工作崗位。

In July, there was a food poisoning outbreak involving 1 000 victims in South Korea linked to the consumption of kimchi contaminated by norovirus. The manufacturing, distribution and sales of all products of the incriminated company were suspended.

Norovirus is the most common viral agent causing acute gastroenteritis worldwide in the form of outbreaks and sporadic cases in humans. It can be spread by the faecal-oral route via contaminated food and water. Besides, person-to-person spread, contact with contaminated objects and aerosol spread are other major routes of transmission. Individuals suffering from norovirus food poisoning may show symptoms which include nausea, vomiting, diarrhoea and abdominal cramps.

To reduce the food safety risk of norovirus, the public is advised to observe good personal and environmental hygiene. Wash hands thoroughly with liquid soap and water after using the toilet, before handling food and before eating. The trade should remind food handlers who exhibit gastrointestinal symptoms to stop handling food. Food handlers infected by norovirus should be symptom free for at least 48 hours before resumption of work.

魚露花甲與副溶血性弧菌
Clams in Preserved Fish Sauce and *Vibrio parahaemolyticus*

最近有多宗食物中毒事故的通報，均涉及同一所食肆進食魚露花甲。有關食肆已按食物安全中心（食安中心）的指示停售及棄置受影響的食品。食安中心進行調查期間，發現從該食物業處所抽取的一個魚露花甲樣本被驗出含過量副溶血性弧菌。

副溶血性弧菌可引起食物中毒，其天然存於海水中，亦常見於海產。由這種致病菌引起的食物中毒，通常與進食未經徹底煮熟或生的海產（尤其是受細菌污染的貝類海產）有關。生的食物與熟食或即食食物接觸，也可能導致交叉污染。副溶血性弧菌食物中毒常見的症狀包括腹瀉、嘔吐、輕微發燒及腹痛。

要預防副溶血性弧菌引致的食物中毒，應把食物放進有蓋或密封的容器內，並存放於雪櫃，以免生與熟的食物或即食食物有接觸。處理生的食物及熟食或即食食物時，應使用不同的器具來處理。食物應徹底烹煮後才可進食。

Recently clusters of food poisoning outbreak involving the consumption of clams in preserved fish sauce in a restaurant were reported. The affected product was stopped from sale and was discarded upon instruction from the Centre for Food Safety (CFS). During the CFS's investigation, a sample of clam in preserved fish sauce collected from the food premises concerned was later found to contain an excessive amount of *Vibrio parahaemolyticus* (VP).

VP can cause food poisoning. It is naturally present in seawater and is often found in seafood. Food poisoning caused by VP is usually associated with the consumption of undercooked or raw seafood, in particular shellfish that is contaminated with bacteria. Cross-contamination can also occur when raw food gets into contact with cooked or ready-to-eat (RTE) food. Common symptoms of food poisoning caused by VP include diarrhoea, vomiting, mild fever and abdominal pain.

To prevent VP related food poisoning, store food in a covered or sealed container in refrigerators to avoid contact between raw food and cooked or RTE food. Separate equipment should be used for handling raw and cooked or RTE food. Food should be cooked thoroughly before consumption.

風險傳達工作一覽（二零二四年九月）
Summary of Risk Communication Work (September 2024)

事故/ 食物安全個案 Incidents/ Food Safety Cases: 440	公眾查詢 Public Enquiries: 180	業界查詢 Trade Enquiries: 271	食物投訴 Food Complaints: 511	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: 3	懷疑食物中毒個案通報 Suspected Food Poisoning Alerts: 2	教育研討會/ 演講/ 講座/ 輔導 Educational Seminars/ Lectures/ Talks/ Counselling: 35	上載到食物安全中心網頁的新訊息 New Messages Put on the CFS Website: 53	