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稻米中的鎘

Cadmium in Rice

食物安全中心

風險評估組

科學主任鄧紹平博士報告

Reported by Dr. Anna S.P. TANG, Scientific Officer,
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今年八月二十日，傳媒報道，廣州有某牌子泰國進口稻米的鎘含量超逾中國內地的法定上限。由於長時間過量攝取鎘可能會損害健康，故食物中的鎘引起市民關注。本文會提供更多有關鎘的食物安全資料。

鎘是什麼？

鎘是天然存在於地殼表面的金屬。此外，又是燃燒化石燃料，焚燒廢物，採礦，電鍍和生產鎘鎳電池、顏料、塑膠穩定劑及肥料等產品時釋出一種污染物。鎘在環境中通常與其他元素結合，成為可溶於水中的固體化合物。鎘不會在環境中分解，但會轉化為不同形態。



稻米 Rice

稻米及其他食物為何含有鎘？

植物和動物會從水和環境中攝取到鎘。稻米和小麥等農作物會輕易從泥土中攝取到鎘，原因是鎘天然存在於泥土中，農民施用含鎘的肥料，或工業污水含有鎘。動物吃下受鎘污染的農作物及植物後，鎘便會在食物鏈中積聚。

人們主要從哪些途徑攝取鎘？

人們通過空氣、水、食物和吸煙攝取到鎘。吸煙和在工作環境中吸入鎘是受影響羣組攝取鎘的兩大來源，但一般人攝取鎘的主要途徑則是經食物。

聯合國糧食及農業組織/世界衛生組織聯合食物添加劑專家委員會(專家委員會)確定，人們攝取鎘的主要來源是下列七大食物類別：稻米、小麥、根莖類蔬菜、塊莖類蔬菜、葉菜類蔬菜、其他蔬菜及軟體類動物。平均而言，人們從這七類食物攝取的鎘分量約佔總鎘攝入量(即每公斤體重2.8微克至4.2微克)的65%。

On 20 August 2008, the media reported that a brand of rice imported from Thailand to Guangzhou contained cadmium exceeding the legal limit of Mainland China. Cadmium in food causes public concern because excessive intake over a prolonged period may pose possible health risk. This article provides more information on food safety relating to cadmium.

What is Cadmium?

Cadmium is a metal present naturally in the earth's crust. It is also a pollutant from burning of fossil fuels, waste incineration, mining, electroplating and manufacture of various products like nickel-cadmium batteries, pigments, plastic stabilisers and fertilisers. Cadmium commonly exists in combinations with other elements in the environment as solids that may dissolve in water. It does not break down in the environment, but it can change its form.

Why is it Present in Rice and Other Foods?

Fish, plants and animals can take up cadmium from water and the environment. Crops such as rice and wheat readily take up cadmium present in the soil, as a result of its natural occurrence, from application of cadmium-containing fertilisers and waste from industrial discharges. Cadmium can go up the food chain when contaminated crops and plants are ingested by animals.

What Contributes to Cadmium Exposure?

Humans are exposed to cadmium through air, water, food and cigarette smoking. While smoking and inhalation in occupational settings are significant sources of cadmium in the exposed groups, foods represent a major route of exposure by the general public.

The Joint Food and Agriculture Organization/World Health Organization Expert Committee on Food Additives (JECFA) identified seven commodity groups that contributed significantly to total intake of cadmium including rice, wheat, root vegetables, tuber vegetables, leafy vegetables, other vegetables and molluscs. On average, these commodities accounted for about 65% of the total intake of cadmium (2.8 – 4.2 µg/kg body weight).

As reported by JECFA in 2005, the highest cadmium level found in over 37 000 rice samples from Europe and Far Eastern regions was 1.2 mg/kg, while the average

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Incident in Focus

正如專家委員會於二零零五年報告中指出，在來自歐洲及遠東地區超過 37 000 個稻米樣本中，雖然鎘含量最高樣本達到每公斤1.2毫克，但平均鎘含量只有每公斤0.061毫克。稻米的鎘含量差異甚大，可能與耕作區內的水是否受鎘污染、土壤中鎘的天然含量和農民所採用的務農方法有關。

鎘的特點如下：

- 可透過泥土及受鎘污染的水進入稻米及其他食物中
- 長時間過量攝取會損害腎臟
- 通過烹煮不能減少鎘含量

本署在二零零二年進行了有關“中學生從食物攝取重金屬的情況”的風險評估研究，以評估本港中學生攝取金屬污染物（包括鎘）的情況。該項研究結果指出，“魚類以外的海產”（即貝類）是中學生攝取鎘的主要食物類別（33%），其次依序為“穀類和穀類食品”（27%）和“蔬菜”（17%）。

食物中的鎘對健康造成的影響

與吸入鎘（例如在工作環境中）的情況不同，從飲食中攝取鎘絕少會引致急性中毒，而現有證據並無顯示這種攝入途徑可能令人患癌。

從飲食中攝取鎘的主要問題是慢性鎘中毒，尤其會損害腎臟，引致出現蛋白尿、糖尿、氨基酸尿等病症。

安全的攝入量

為保障公眾健康，專家委員會已訂定鎘的安全攝入量，即暫定每周可容忍攝入量為每公斤體重7微克。由於暫定每周可容忍攝入量着眼於人一生的攝入量，只要平均攝入量並非長期超出這一數值，偶然高於暫定每周可容忍攝入量也不會影響健康。

本港情況如何？

根據二零零二年的風險評估研究，攝取量一般的中學生每周從食物攝取的鎘，按每公斤體重計算為2.49微克，而攝取量高的中學生則為5.71微克，兩者均低於每周可容忍攝入量，即表示在香港從正常飲食中攝入鎘以致對健康造成不良影響的機會不大。

如何監察在本港食物中的鎘？

中心一向透過食物監察計劃監察食物中的鎘。食物中准許的鎘含量受《食物攪雜（金屬雜質含量）規例》（第132V章）所規管。在二零零六年至二零零八年八月期間所抽取的稻米樣本，當中包括五個因應是次事件抽取的泰國米樣本，在鎘測試中結果滿意。

給業界和消費者的建議

農民應奉行優良務農規範，以減少食用農作物受到鎘污染。業界應確保所出售或進口的食物適宜供人食用，並符合法定標準。至於消費者，則應保持均衡飲食，以免因偏食少種類食物而過量攝取某些化學物或污染物。

更多資料

讀者如欲在這方面取得更多資料，請瀏覽下列網頁：

- 有關“食物中的鎘”的風險簡訊；
- 《食物安全焦點》內的《鎘與食物安全》；
- 《食物安全焦點》內的《蠔中的鎘》。

concentration was 0.061 mg/kg. The wide range of cadmium levels found in rice may depend on presence of contaminated waters in the farming area, level of cadmium naturally present in soil and the agricultural practices adopted.

Cadmium:

- is present in rice and other foods through uptake from soil and contaminated water
- can be harmful to the kidney over prolonged excessive intake
- cannot be reduced by cooking

In 2002, our Department conducted a risk assessment study on “Dietary Exposure to Heavy Metals of Secondary School Students” to assess the intake of metallic contaminants including cadmium in Hong Kong. Results of this study indicated that the food group “seafood other than fish”, particularly shellfish, was the main contributor (33%) of dietary exposure to cadmium, followed by the “cereal and cereal products” (27%) and “vegetables” (17%) groups.

Health Concerns of Cadmium in Food

Unlike inhalation of cadmium such as in occupational settings, intake of cadmium from the diet rarely causes acute toxicity, and existing evidence does not indicate cancer-causing potential through oral intake.

The main concern of cadmium from dietary exposure is its chronic toxicity, particularly in the kidney. Adverse effects such as abnormal excretion of protein, glucose and amino acid in urine have been observed in humans.

Safe Intake Level

A safe intake level for cadmium has been established by JECFA to protect public health. This level, called the Provisional Tolerable Weekly Intake (PTWI), is set at 7 µg/kg body weight (bw). Transient excursion above the PTWI would have no health consequences provided that the average intake does not continuously exceed the PTWI which emphasises on a lifetime exposure.

What is the Local Situation?

The 2002 risk assessment study showed that dietary exposure to cadmium for the average and high consumers were 2.49 and 5.71 µg/kg bw per week respectively, both below the PTWI, indicating that adverse health effects due to exposure to cadmium upon normal consumption of foods in Hong Kong are unlikely.

How is Cadmium in Food Monitored in Hong Kong?

The CFS has been monitoring cadmium in foods under the food surveillance programme. The level of cadmium allowed in food is governed by the Food Adulteration (Metallic Contamination) Regulations, Cap. 132V. Between 2006 and August 2008, all rice samples taken for the analysis of cadmium, including five Thai rice samples taken in response to the incident, had been satisfactory.

Advice to the Trade and Consumers

Farmers should observe Good Agricultural Practice to minimise cadmium contamination in food crops. Traders should ensure that the foods they sell or import are fit for human consumption and comply with legal standards. Consumers are advised to take a balanced diet so as to avoid excessive exposure to certain chemicals or contaminants from a small range of food items.

Further Information

Interested readers may visit the following web pages for further information relating to the subject:

- [Risk in Brief on “Cadmium in Food”](#);
- [Food Safety Focus article “Cadmium and Food Safety”](#);
- [Food Safety Focus article “Cadmium in Oysters”](#).

食物中的生物危害：病毒

Biological Hazard in Food – Viruses



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,
Risk Assessment Section,
Centre for Food Safety

本欄在上兩期概述了致病細菌後，今期將會探討食物中的病毒。它們比細菌細10倍甚至100倍，即使放在光學顯微鏡下，我們亦無法看見。

病毒

簡言之，病毒是由遺傳物質（即脫氧核糖核酸或核糖核酸）加上一個蛋白質及／或膜狀外層所組成，除了體形比細菌細小之外，兩者的特性亦極為不同。細菌可在適當的環境中生長和繁殖。至於病毒，則需先感染一個細胞，把遺傳物質帶進該細胞，然後利用細胞本身的資源去製造更多病毒，繼而入侵更多細胞。由於病毒需要細胞才能複製，故無法在食物和水中生長。下表顯示與食源性疾病有關的病毒及細菌的一般特性：

	病毒	細菌
生長情況	必須依附在宿主細胞才可製造更多病毒	在適合的環境中生長和繁殖
能否令食物腐壞	不能	腐敗細菌能夠
能否產生孢子	不能	有些細菌能夠
感染劑量	相信只需很少數目	可以很少數目，但有些細菌需較多數目才能令人染病或產生毒素
令人生病的方式	入侵人體細胞	入侵人體，然後在體內繁殖或產生毒素

雖然病毒數目在受污染食物中不會增加，但大部分病毒相信只需很少數目（10至100個可致病的病毒粒子）便可傳播疾病。這一特點與由致病細菌引致的食物中毒明顯有別，因為致病細菌須大量繁殖才能令人染病或產生毒素使人生病。此外，大部分食源性或水源性病毒都較能忍受熱力、消毒物品和酸鹼度的改變。

食物中能夠令人患病的病毒

食源性或水源性病毒可按其所引致的疾病（即腸胃炎、肝炎及其他疾病）分為三大類，有關例子見下表：

種類	腸胃炎	肝炎	其他
病理變化	胃部、小腸及大腸發炎	肝臟發炎	在人體腸道內繁殖，但在進入其他器官後才會令人生病
例子	諾如病毒(前稱諾沃克病毒) 輪狀病毒 星狀病毒(A組至C組) 腺病毒(40型或41型)	甲型肝炎病毒 戊型肝炎病毒	腸病毒，例如脊髓灰質炎病毒、伊科病毒、腸病毒(68型至71型)

資料來源：食品法典委員會在一九九九年及二零零五年發出有關食物中的病毒的討論文件

在可引致腸胃炎的病毒中，諾如病毒一向是本港食物中毒個案中最常見的病毒媒介。病毒性腸胃炎常會引致嘔吐或腹瀉。

甲型或戊型肝炎病毒與受污染的食物或水有關，並會引致甲型或戊型肝炎。在本港，甲型肝炎沒有以往那麼常見，但戊型肝炎感染上升的趨勢卻令人注意。

腸病毒是一組包括多種類型和可引致不同病徵的病毒。大部分腸病毒主要會由腸壁入侵，並且會在進入其他器官如中樞神經系統或肝臟等後引致其他疾病。

食源性病毒或水源性病毒的傳播途徑

病毒可透過受污染食物以外的其他途徑傳播，例如直接

After having an overview of pathogenic bacteria in the last two issues, we are going to see another bug in food, which is around 10 to 100 times smaller than bacteria and is not visible under a light microscope – the virus.

Viruses

Viruses, in brief, are composed of genetic materials, i.e. DNA or RNA, enclosed by a protein and/or membranous coat. They are very different from bacteria besides just being smaller. Bacteria can grow and multiply in suitable environment. For viruses, they need to infect a cell and pass their genetic materials into that cell. Subsequently, they use the cell's resources to produce more viruses which will then invade more cells. As they require a cell to replicate, the viruses are not able to grow in food and water. Some general characteristics of viruses and bacteria related to foodborne disease are shown in the table below:

	Virus	Bacteria
Growth	Require a host cell to produce more virus	Can grow and multiply in suitable environment
Spoilage of food	No	Spoilage bacteria can
Formation of spore	No	Some can
Infective dose	Presumably low	Can be low, but some require high dose to infect or produce toxins
Cause illness by	Invalidate human cells	Invalidate and multiply in the body or produce toxin

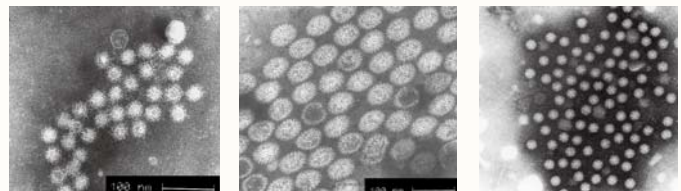
Although the number of viruses in contaminated food will not increase, the infective dose of most viruses is presumably low (10 to 100 infectious viral particles). This feature is clearly distinct from food poisoning caused by pathogenic bacteria where the bacteria grow to large number to infect or produce toxin to cause illness. In addition, most foodborne or waterborne viruses are relatively resistant to heat, disinfection and pH changes.

Viruses in Food that can Cause Disease

The foodborne or waterborne viruses can be divided into three types according to the diseases caused by them: (i) gastroenteritis; (ii) hepatitis; and (iii) other illness. Examples are shown in the table below:

Type	Gastroenteritis	Hepatitis	Other
Pathological changes	Inflammation of the stomach and small and large intestines	Inflammation of the liver	Replicate in human intestine but cause illness after they migrate to other organs
Examples	Norovirus Rotavirus Astrovirus (group A to C) Adenovirus (type 40 or 41)	Hepatitis A virus Hepatitis E virus	Enteroviruses, e.g. Poliovirus, Echovirus, Enterovirus (type 68 to 71)

Source: Codex Alimentarius Commission, Discussion Papers on the Viruses in Food, 1999 and 2005



電子顯微鏡下的(由左至右:)諾如病毒、輪狀病毒及星狀病毒(照片來源:香港衛生署衛生防護中心)

(From left to right:) Norovirus, rotavirus and astrovirus as seen under electron microscope (Photos: Centre for Health Protection, Department of Health, Hong Kong)

Among the viruses that cause gastroenteritis, norovirus has been the commonest viral agent associated with food poisoning in Hong Kong. Viral gastroenteritis commonly results in vomiting or diarrhoea.

Types A and E of hepatitis viruses are related to contaminated food or water and can cause hepatitis A and E respectively. Locally, hepatitis A is found to be less prevalent than before, but attention has been drawn over the increasing trend of hepatitis E infection.

Enteroviruses are a diverse group which contains many types of

或間接經受感染者的糞便或嘔吐物傳播。這都是常見的病毒傳播途徑，尤其是在護養院或安老院等院舍環境。如病毒是透過其他途徑傳播，我們便可能不知道引致病毒感染的食物來源或水源。

預防從食物中感染病毒

病毒感染的其中兩個主要來源是貝類和由受感染食物從業員所處理的食物。由於貝類會把水域中的病毒積聚，而人們可能會吃生或未徹底煮熟的貝類，故貝類可以是食源性病毒感染的來源。此外，受感染或曾接觸病人的食物從業員亦會透過食物傳播病毒。在一些情況下，受感染的食物從業員可能只是帶菌者（例如在康復期間或潛伏期），未必會出現病徵。

為預防食源性病毒感染，必須嚴格遵從環境、食物及個人衛生守則。食具應徹底清潔，然後才使用。大家（特別是食物從業員）應保持雙手清潔，例如經常洗手，而出現腸胃炎/肝炎病徵的人應在醫生建議的指定時間內避免處理食物。另一方面，大家應向信譽良好及可靠的來源購買貝類等高風險食物。至於兒童、長者或孕婦等容易受感染的羣組，則應避免進食生的貝類或海產。此外，進食前徹底煮熟貝類亦能預防由細菌或病毒引致的食物中毒。

enteroviruses and associates with a wide range of symptoms. The lining of gut is the primary site of infection for most of the enteroviruses and they can cause other illness after migrating to other organs like the central nervous system or the liver.

Transmission of Foodborne or Waterborne Viruses

Viruses can be transmitted via paths other than contaminated food, like directly or indirectly through the faeces or vomits of an infected person. This is common especially in an institutional setting such as nursing home and elderly centre. Other routes of transmission may mask the original food or water source.

Prevention of Getting Viruses from Food

Two of the main sources of viral infection are shellfish and food items handled by infected foodhandlers. Shellfish can be a source of foodborne viral infections because of their ability to concentrate viruses present in the water environment and they may be consumed raw or undercooked. Infected food handlers or food handlers who have come into contact with sick people can help to spread the virus via food. In some cases, an infected foodhandler may not have symptoms (carrier status), like during the recovery or incubation period.

To prevent foodborne viral infection, strict observance of environmental, food, and personal hygiene is important. Dining utensils should be cleaned thoroughly before use. People, especially food handlers, should keep hands clean, e.g. by frequent handwashing, and those with gastroenteritis/hepatitis symptoms should avoid preparing food in a time-frame as advised by a doctor. On the other hand, high risk food like shellfish should be bought from reputable and reliable suppliers. Susceptible populations such as children, elderly or pregnant women should avoid consuming raw shellfish or seafood. Moreover, cooking shellfish thoroughly before consumption can prevent both bacterial and viral food poisoning.

食物事故點滴 Food Incident Highlight

大腸菌羣與軟雪糕

品調查。

食物安全中心最近公布有關雪糕含微生物情況的專項食品調查。

這項專項食品調查從零售店舖及批發公司抽取了不同款式約 1 000 個雪糕製品，進行細菌含量和致病菌測試。所有樣本均沒有發現致病菌，包括沙門氏菌和金黃葡萄球菌。不過，卻有兩個軟雪糕樣本驗出大腸菌羣含量分別為每克 570 個和每克 170 個，超出法例所訂每克少於 100 個的標準。中心已向有關食肆發出警告信。

大腸菌羣並非單一品種的細菌，而是一組呈桿狀結構的革蘭氏陰性細菌，常用來監察食物的品質。它們具有類似的生化特性：處於攝氏 35 度的環境下可於 48 小時內發酵乳糖產生酸和氣體，並可以在有或無氧的環境下繁殖。未經加工的奶類、肉類及家禽或其他生的食物通常會有少量大腸菌羣。由於大腸菌羣含量測試簡單方便，因此會在常規的化驗中用作反映一般微生物質量的衛生指標。由於熱力能輕易殺死大腸菌羣，故這類細菌的存在亦可用作顯示熱處理方法不當(例如雪糕漿在巴士德消毒過程中沒有經過足夠的熱處理程序)，又或食物經熱處理後再受污染(例如受食物從業員和不潔機器所污染)。

食肆如提供軟雪糕，應確保其食物適宜供人食用，並符合法例要求。此外，亦應在配製和處理軟雪糕期間遵從良好衛生守則。

Coliform and Soft Ice-cream

The Centre for Food Safety (CFS) had recently announced the results of a targeted surveillance on the microbiological quality of ice-cream.

About 1 000 ice-cream products were sampled for testing of bacteria level and pathogens during the targeted survey. Different types of ice-creams were collected from both retail and wholesale establishments. No pathogens, including *Salmonella* spp. and *Staphylococcus aureus*, were detected in any samples. However, two samples of soft ice-cream were found to contain 570 and 170 coliform organisms per gram respectively, which exceeded the legal standard of less than 100 per gram. Warning letters were issued to the food premises concerned.

Coliforms, which are often used to monitor food quality, are not a single species of organism. They are a group of gram negative rod-shaped bacteria that have similar biochemical characteristics of being able to ferment lactose with the production of acid and gas within 48 hours at 35°C and grow with or without oxygen. They are usually present in small number in raw milk, meat, poultry or other raw foods. Coliforms count is simple and easy to conduct, hence it can be used as an *hygienic indicator* to reflect the general microbiological quality in routine test. As coliform organisms can easily be killed by heat, these bacteria can also be used as an indicator of heat treatment failure (e.g. inadequate heat treatment during pasteurisation of soft ice-cream mix) as well as post heat treatment contamination (e.g. contamination by food handlers or unclean machines).

Food premises which provide soft ice-cream should ensure that their food are fit for consumption and meet legal requirements. They should observe *good hygiene practices* when preparing and handling soft ice-cream.



軟雪糕 Soft ice-cream

風險傳達 工作一覽 Summary of Risk Communication Work

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