食物安全焦點
Food Safety Focus

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Powdered Infant Formulas (PIF) are Not Sterile – *Salmonella* is Not Acceptable

食物安全中心風險傳達組科學主任莊梓傑博士報告

Reported by Dr. Ken CHONG, Scientific Officer, Risk Communication Section, Centre for Food Safety

背景

二零一七年十二月，法國爆發涉及飲用嬰兒配方奶粉的嬰兒感染沙門氏菌個案，以致涉事公司的相關產品必須回收。在確定有關產品有在本港出售後，食物安全中心(中心)已指令業界回收。本文會討論嬰兒配方奶粉出現的致病菌，以及有關安全配製嬰兒配方奶粉的建議。

與嬰兒配方奶粉有關的致病菌

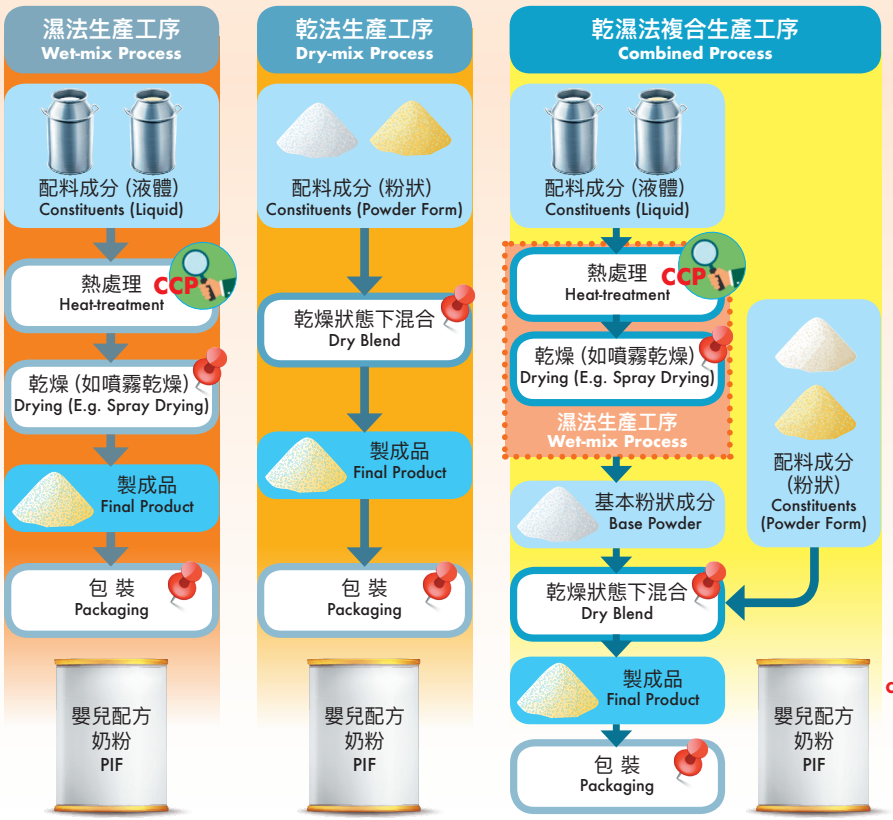
多年前，嬰兒配方奶粉相關的食物中毒爆發個案備受國際關注。聯合國糧食及農業組織/世界衞生組織(糧農組織/世衞)舉行專家會議，評估多宗嬰兒配方奶粉導致嬰兒患病個案涉及的特定微生物。結論確認受克洛諾菌屬(前稱阪崎氏腸桿菌)及沙門氏菌污染的嬰兒配方奶粉，是令嬰兒受感染的媒介及源頭。事實上，克洛諾菌屬及沙門氏菌均能夠長時間在乾燥環境(例如乾製食品及食品加工處理環境)下生存。有些個案亦確定嬰兒配方奶粉本身被這些微生物微量污染。

Background

In December 2017, the consumption of PIF was implicated as the vehicle of *Salmonella* outbreak among infants in France and the implicated products from concerned company had to be recalled. After confirming local availability, the Centre for Food Safety (CFS) instructed traders to recall concerned products. In this article, the presence of pathogens in PIF and relevant recommendations on safe preparation of PIF are discussed.

Pathogens of Concern in PIF

Food poisoning outbreaks associated with PIF raised international concerns years ago; the Food and Agriculture Organization (FAO) of the United Nations/World Health Organization (WHO) expert meetings evaluated specific microoganisms in PIF that resulted in cases of illness in infants, which concluded that PIF contaminated with *Cronobacter* species (formerly *Enterobacter sakazakii*) and *Salmonella* has been convincingly shown to be the vehicle and source of infection in infants. In fact, both *Cronobacter* species and *Salmonella* are able to survive in dry environments (like dried food and food processing environment) for prolonged periods of time. Also, low-level intrinsic contamination in PIF by these microorganisms has been confirmed in some previous outbreaks.



各類嬰兒配方奶粉生產工序的簡化示圖。
Simplified schematic illustration on different process types for production of PIF.

焦點個案
Incident in Focus

嬰兒配方奶粉並非無菌產品

一些人可能以為嬰兒配方奶粉是無菌產品，但現有科技仍無法生產無菌的嬰兒配方奶粉。一般而言，嬰兒配方奶粉是按三種生產工序製造:濕法生產工序、乾法生產工序及乾濕法複合生產工序(見上圖)。液態奶類可透過在容器進行熱處理消毒(即經消毒的奶類)；又或透過持續流動系統進行熱處理，再以無菌方式注入已消毒的容器(即超高溫法處理的奶類)。與液態奶類不一樣，嬰兒配方奶粉須在乾燥狀態下生產，而生產過程涉及在不是無菌的情況下把配料成分進行乾燥或乾燥狀態下混合，並可能添加不耐高溫的配料。此外，由於在乾燥環境中細菌通常更耐熱的特性，故難以在這類製成品中完全消滅活致病菌。

嬰兒配方奶粉在生產過程中受污染的源頭較可能與加工處理的環境、設備及原材料出現的微生物有關。在濕法生產工序及複合生產工序中，熱處理步驟通常會令有關的致病菌數量大減，故一般會視作製造產品的控制重點(CCP)。因此，如有製成品受污染，很大可能是產品在乾燥後及後段的加工處理步驟期間受加工處理環境及/或設備污染所致。另一方面，在乾法生產工序及複合生產工序，乾燥狀態配料的微生物質素須符合製成品的要求，因為各種粉狀配料在混合期間或之後均不再有減少微生物的工序。因此，混合的步驟應在嚴格的衞生環境下進行，以避免受污染。為減低在各種生產工序中出現交叉污染，製造商應推行持續的微生物監察計劃，監察廠房進行乾燥、混合及包裝步驟的四周環境，以及與食物接觸的表面/設備。

有關沖調嬰兒配方奶粉的建議

雖然嬰兒配方奶粉並非無菌產品，在打開包裝後亦可能會受污染，但在餵哺前妥善沖調可減低出現微生物危害的風險。糧農組織/世衞建議，嬰兒配方奶粉應以不低於攝氏70度經煮沸的水配製，以便能有效消滅活致病菌(包括沙門氏菌)。沖調好的奶應冷卻至可餵哺的溫度，然後立即飲用。沖調好的奶若未能在兩小時內飲用，便應倒掉。對於高風險嬰兒(包括未滿兩個月、早產、出生體重不足(少於2.5公斤)及免疫力較弱的嬰兒)，如未有以母乳餵哺，如情況許可，照顧者宜選用經商業無菌處理的液態嬰兒配方。

中心所採取的行動

在接獲歐洲委員會的通報，指涉事產品曾進口香港，中心已指令有關進口商將涉事批次產品停售及下架，並回收相關產品。

注意事項:

1. 嬰兒配方奶粉並非無菌產品，可能受致病菌污染，導致嬰兒患上嚴重疾病。
2. 嬰兒配方奶粉應以不低於攝氏70度經煮沸的水配製，以便能有效消滅活致病菌(包括沙門氏菌)。
3. 製造商及照顧者均須採取控制措施，盡量減低微生物風險，確保嬰兒配方奶粉適宜飲用。

給照顧者的建議

- 用作餵哺嬰兒及配製奶粉的所有設備均須徹底清潔及消毒。
- 留意配製嬰兒配方奶粉的衞生及安全方法，糧農組織/世衞發出的現有指引亦有作出有關建議。

給製造商的建議

- 推行預防措施(例如優良製造規範/良好衞生守則及“食物安全重點控制”系統)和監控及環境管理計劃。
- 在產品標籤上詳列照顧者應依從的控制措施，以便他們安全配製、處理及使用嬰兒配方奶粉。

PIF are Not Sterile

Some people may expect that PIF are sterile products, yet current technology does not achieve the production of sterile PIF. Generally, PIF are manufactured according to three process types: a wet-mix process, a dry-mix process, and a combined process (see illustration above). Unlike liquid milk which can be sterilised by heat-treatment in-container (i.e. sterilised milk) or by heat-treatment in a continuous flow system followed by aseptic filling in a sterilised container (i.e. ultra-high temperature treatment milk), PIF have to be produced in dried form where drying or dry blending under non-sterile condition is involved and heat-sensitive ingredients may also be added. It is difficult also to completely inactivate microbial pathogens in the final product as bacterial cells under dry condition usually exhibit increased heat resistance.

Sources of contamination in PIF production can be related to the presence of microorganisms in the processing environment and equipment as well as raw materials. In the wet-mix and the combined processes, the heat-treatment step usually results in significant reduction of the concerned pathogens, and is therefore considered as a critical control point (CCP) in product manufacturing. Contamination of final products, if any, would therefore most likely a result of contamination from processing environment and/or equipment after the drying and during subsequent processing steps. On the other hand for the dry-mix and the combined processes, the microbiological quality of the dry-mix ingredients should meet the requirements for the finished products as there is no further microorganism reduction process during and after mixing of various powdered ingredients. The blending should therefore be done under strict hygienic conditions to avoid contamination. To minimise cross-contamination in all process types, manufacturers should implement ongoing microbiological monitoring programmes for the drying, blending and packaging areas of the plant and for food contact surfaces/equipment.

Recommendations on Reconstituting PIF

Although PIF are not sterile products and can also be contaminated after opening, proper reconstitution prior to feeding could decrease risk from microbiological hazards. The FAO/WHO advises that PIF should be prepared with boiled water no cooler than 70°C, which can significantly inactivate pathogens including *Salmonella*. Reconstituted PIF should then be cooled to feeding temperature and consumed immediately. Reconstituted PIF that have not been consumed within two hours should be discarded. For high-risk infants (including infants less than two months of age, pre-term infants, low-birth-weight infants (<2.5kg), and immunocompromised infants) who are not breastfed, caregivers should use commercially sterile liquid formulas whenever possible.

Actions Taken by the CFS

Upon receiving notifications of the European Commission that the affected products have been imported into Hong Kong, the CFS instructed the importer concerned to stop sale and remove from shelves the affected batches of the products, and recall the products concerned.

Key Points to Note:

1. PIF are not sterile products and may be contaminated with pathogens that can cause serious illness in infants.
2. PIF should be prepared with boiled water no cooler than 70°C which can significantly inactivate pathogens including *Salmonella*.
3. Control measures have to be applied by both manufacturers and caregivers to minimise the microbiological risk and to assure the suitability of PIF.

Advice to Caregivers

- Thoroughly clean and sterilise all equipment used for feeding infants and for preparing feeds.
- Beware of the hygienic and safe practices for preparing PIF which are also recommended in prevailing guidelines issued by the FAO/WHO.

Advice to Manufacturers

- Implement preventive measures (such as Good Manufacturing Practice/Good Hygienic Practice and Hazard Analysis and Critical Control Point) as well as monitoring and environmental management programmes.
- Communicate the control measures that the caregivers should follow for the safe preparation, handling and use of PIF on product label.

食物安全平台
Food Safety Platform

降低預先包裝食品的鹽含量
Reduction of Salt in Prepackaged Foods

食物安全中心風險傳達組
科學主任何國偉先生報告

Reported by Mr. Nicky HO, Scientific Officer
Risk Communication Section, Centre for Food Safety

從膳食中攝取鹽/鈉分量與健康息息相關。攝取過多的鈉會增加患高血壓的機會，亦會增加患上中風及冠心病的風險。世界衞生組織(世衞)制訂了一套預防及控制非傳染性疾病的指標及自願的全球目標；並訂下目標，在二零二五年或之前，平均人口的鹽攝入量要相對減少30%。世衞認為，推動業界改良食品配方以減少食物中所含的鹽分，對減低市民的鹽攝入量至關重要，是其中一項應率先採取的行動。

改良預先包裝食品的配方

考慮到食物安全、品質及消費者接受程度，改良食品配方是廣被採用的方法，以降低市民從預先包裝食品及食肆食物攝入鹽的分量。以下三個辦法有助把食物中的鹽含量在一段時間內減至最低水平：(i)逐漸減少或除去鹽/鈉的分量；(ii)使用鈉代替品；以及(iii)調整產品包裝大小(見圖)。

預先包裝食品的製造商可逐漸減少所使用的鹽的分量。製造商亦可採購較低鈉含量的配料。有關資料可向供應商索取。

使用鈉代替品亦可降低預先包裝食品的鈉含量。天然的配料(例如檸檬、番茄)或香草及香料(例如辣椒) 可用作調味。

業界可提供各種分量的預先包裝食品予顧客選擇。如無法提供分量較小的預先包裝食品，可改良包裝(例如使用密實袋或可重複密封的盒)，令剩餘的食物妥善保存，以便日後食用。

降低食物中鹽含量的常見方法。
Common methods for reducing the salt contents in foods.

改良食品配方是實際可行

鹽在食物中的作用及功用視乎食物的性質而定，因此，就不同食物訂定減鈉目標是複雜的工作。雖然如此，不少國家(例如美國、英國及加拿大)已就各食物類別訂定減鈉目標，以逐漸降低納含量，作為向食物業界推動改良食品配方的平台。

外國已證明改良食品配方是實際可行的。在愛爾蘭，香腸及多種早餐穀類食品的鈉含量在二零零三年至二零一五年大幅降低(香腸減少11%，早餐穀類食品則減少38%至63%不等)。在英國，某茄汁產品的鈉含量在二零零零年至二零一二年減少了39%。

事實上，本地市場已有鈉含量較低的預先包裝食品出售(例如減鈉鼓油及減鈉午餐肉)。因此，業界降低預先包裝食品的鈉含量是可行的。

Dietary salt/sodium intakes are closely related to health. Excessive sodium intake will increase the risk of developing hypertension, stroke and coronary heart disease. The World Health Organization (WHO) had developed a set of indicators and voluntary global targets for the prevention and control of non-communicable diseases and a target of 30% relative reduction in mean population intake of salt by 2025 had been set. The WHO opines that promoting product reformulation to contain less salt is essential in order to reduce population salt intake and should be one of the first actions considered, amongst others.

Product Reformulation of Prepackaged Food

After taking food safety, quality and consumer acceptance into consideration, product reformulation is the widely adopted approach to reduce the salt intake in prepackaged and restaurant foods. Three initiatives have been identified to reduce the salt contents in foods to the lowest level possible over time: (i) to reduce or remove the amount of salt/sodium to the minimum little by little, (ii) to replace the sodium uses with alternatives, and (iii) to resize the package of products (see illustration).

Manufacturers of prepackaged foods can gradually reduce the amount of salt used. They can also source and target ingredients with lower sodium contents. Such information could be obtained from their suppliers.

Replacing the sodium uses with alternatives could also reduce the sodium contents in prepackaged foods. Natural ingredients (e.g. lemon, tomato) or herbs and spices (e.g. chilli) could be used for flavouring.

Range of portion sizes of prepackaged foods can be offered for customers to choose. If smaller portion size is not possible, package can be improved for proper storage of the remaining food for other eating occasions (e.g. use of zipper bags or resealable boxes).

Product Reformulation is Feasible and Practical

The process of setting targets for sodium reduction in foods is complex since the role and function of salt vary depending on the nature of the food. Nevertheless, many countries (e.g. the United States, the United Kingdom (UK), and Canada) have established sodium reduction targets in various food categories for gradual reduction in sodium, which serve as a platform to promote product reformulation to the food industry.

Product reformulation had been found practical in overseas. In Ireland, there were substantial reductions of sodium content in sausages (11% reduction) and various breakfast cereals products (38%-63% reduction) from 2003 to 2015. In the UK, the sodium content of a ketchup product had been reduced by 39% from 2000 to 2012.

Indeed, prepackaged foods with reduced sodium contents are available in local market (e.g. reduced sodium soy sauce and luncheon meat). So, it is feasible for trade members to reduce the sodium contents of prepackaged foods.

業界的支持及參與

由於對公共健康會造成影響，業界應留意所出售的預先包裝食品的鹽含量。因此，業界應積極參與降低食物中的鹽含量，並參考食物安全中心所編製的《降低食物中鈉含量的業界指引》及外國機構制定的減鈉目標，致力改良食物配方，向市民提供更多優質的少鹽食品。

此外，二零一七年十月，在食物業界的支持下，降低食物中鹽和糖委員會與政府共同推出自願性質的預先包裝食品「鹽／糖」標籤計劃，以協助消費者容易辨認低鹽低糖的產品。若預先包裝食品符合《食物及藥物(成分組合及標籤)規例》(第132W章)下「低鹽」、「無鹽」、「低糖」及「無糖」的聲稱條件，業界可在預先包裝食品展示「鹽／糖」標籤。

Trade Support and Participation

Trade members should be aware of the salt contents of their prepackaged foods on sale as they have public health implication. As a result, trade members should actively participate in reducing salt contents in foods. They could make greater efforts to reformulate food recipes to provide more quality foods with less salt to the public with reference to the Trade Guidelines for Reducing Sodium in Foods developed by the Centre for Food Safety and the sodium reduction targets established by overseas authorities.

In addition, the Committee on Reduction of Salt and Sugar in Food and the Government jointly introduced a voluntary "Salt / Sugar" Label Scheme for Prepackaged Food Products with the support of food trade in October 2017 to assist consumers to easily identify low-salt-and-sugar products. Trade members can display the "Salt / Sugar" Labels on their prepackaged food products which meet the claim conditions of "low salt", "no salt", "low sugar" and "no sugar" under the Food and Drugs (Composition and Labelling) Regulations (Cap.132W).

食物事故點滴
Food Incident Highlight

鹵味是高風險的即食食品
Lo-mei are High-risk Ready-to-eat Food

二零一七年年底，數批消費者在一間食肆用膳(包括進食鹵味)後，先後出現腹痛、嘔吐及腹瀉等病徵。在香港，根據《食物業規例》(第132X章)附表2，鹵味被視作限制出售的食物，其製造及出售均受發牌制度的監管。

鹵味屬即食食品，經最初熱處理後，極少會在食用前翻熱，因此屬高風險食品。把鹵味長時間存放在室溫下(即在攝氏4度至60度之間的危險溫度範圍內)的做法，以及涉及大量人手處理步驟，亦令鹵味受微生物污染的風險大增。因此，業界可採取多項措施，制止致病菌進入鹵味、交叉污染及繁殖(見食物安全計劃)，以助預防食物中毒。消費者應光顧持牌食肆，並在購買鹵味後，盡快進食。

In late 2017, a few clusters of consumers developed abdominal pain, vomiting and diarrhoea after having meals containing lo-mei dishes in a restaurant. In Hong Kong, lo-mei are considered restricted food and their manufacturing and sale are subject to licensing control under Schedule 2 of the Food Business Regulation (Cap. 132X).

Lo-mei are high risk food because they are ready-to-eat and seldom reheated after initial heat treatment prior to serving. The practice of prolonged storage at ambient temperatures (within the danger zone of 4°C-60°C), and substantial manual handling also fuelled the risk of microbiological contamination. Hence, traders can help prevent food poisoning by taking various measures that abort the introduction, crossing-contamination and multiplication of pathogens (see Food Safety Plan). Consumers are advised to patronise licensed food premises and consume lo-mei as soon as possible after purchase.

進食昆蟲及食物安全
Insects Eating and Food Safety

最近，有傳媒報道，加入壓碎蟋蟀作為材料的麵包在歐洲推出發售，再度引起公眾關注。事實上，人類使用昆蟲作為食物(食蟲)已有悠久歷史。聯合國糧食和農業組織表示，全球有超過1 900種可食用昆蟲(例如甲蟲、螞蟻及蚱蜢)已被用作食物，可為日益增加的人口提供持續的營養來源。食用昆蟲可來自野生捕捉昆蟲、半馴養野生昆蟲及養殖昆蟲。

進食昆蟲並非沒有風險。與其他食物一樣，食用昆蟲可能含有致病菌或寄生蟲，故必須在衞生的環境下以合乎衞生標準的方式處理食用昆蟲。對甲殼類動物(例如蝦蟹)過敏的人亦有可能對食用昆蟲過敏 —— 兩者均屬無脊椎動物，或會含有某類特殊的蛋白質，引致過敏反應。業界須確保在香港出售的所有食物(不論是否食用昆蟲)適宜供人食用，並符合本港法例規定，包括在預先包裝食物加上標籤的規定。

Recently, the media reported the sale of bread made with crushed crickets in Europe which drew public attention again. In fact, the human use of insects as food (entomophagy) has a long history. The Food and Agriculture Organization of the United Nations stated that over 1 900 edible insect species (e.g. beetles, ants and grasshoppers) are eaten worldwide, which could provide a sustainable source of nutrition for a growing population. They could be sourced by wild harvesting, semi-domestication of insects in the wild, and farming.

Insects-eating is not risk-free. As any other food, edible insects may contain pathogens or parasites, so they must be handled under the sanitary standards and conditions. People who are allergic to crustaceans (e.g. shrimps and crabs) may also be allergic to edible insects – both are invertebrates that may contain specific proteins causing allergic reactions. Traders shall ensure that all foods (regardless of edible insects) sold in Hong Kong are fit for human consumption and comply with local legislations, including labelling requirements for prepackaged foods.

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

風險傳達工作一覽（二零一七年十二月） Summary of Risk Communication Work (December 2017)	數目 Number
事故/食物安全個案 Incidents / Food Safety Cases	111
公眾查詢 Public Enquiries	45
業界查詢 Trade Enquiries	130
食物投訴 Food Complaints	475
給業界的快速警報 Rapid Alerts to Trade	10
給消費者的食物警報 Food Alerts to Consumers	2
教育研討會/演講/講座/輔導 Educational Seminars / Lectures / Talks / Counselling	25
上載到食物安全中心網頁的新訊息 New Messages Put on the CFS Website	48