風險評估研究
Risk Assessment Studies

食物中的吡咯里西啶類生物鹼

Pyrrolizidine Alkaloids (PAs) in Food

食物環境衞生署
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食物安全中心
Centre for Food Safety

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- 結果、討論和建議

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- Objectives
- Background
- Methodology and chemical analysis
- Results, discussion and recommendations

目 的

- 選取的食物中
  - ✓ 檢測 PAs 的總和;
- 估算本港成年人
  - ✓ 從膳食攝入 PAs 的分量;和
- 評估對健康帶來的風險

Objectives
- to determine the total sum of PAs in selected food items;
- to estimate the dietary exposure to PAs of the HK adult population; and
- to assess the associated health risks.

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吡咯里西啶類生物鹼

- 次級化合物
  - ✓不直接參與生物的正常生長，發育或繁殖
  - ✓防止草食動物

Pyrrolizidine Alkaloids (PAs)

- secondary metabolites
  - ✓are not directly involved in the normal growth, development, or reproduction of an organism
  - ✓to ward off herbivores

吡咯里西啶類生物鹼

- 天然毒素
  - ✓ 存在於各種植物物種中
- 可給農民帶來嚴重的經濟損失
- 可對人類構成風險

Pyrrolizidine Alkaloids (PAs)

- natural toxins
  - ✓ found in a wide variety of plant species
- can cause severe economic losses to farmers
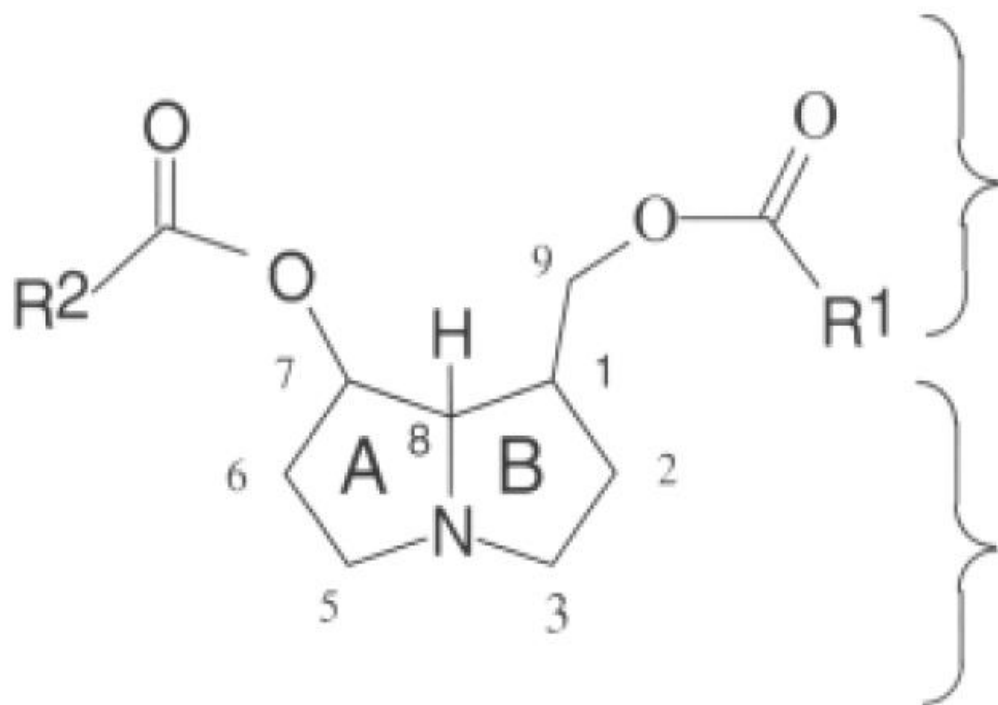- possibility of risk to humans

吡咯里西啶類生物鹼

- 6 000多種植物
- 開花植物的3%
- 約660多種 PAs

Pyrrolizidine Alkaloids (PAs)
- over 6 000 plant species
- 3% of the world's flowering plants
- approximately 660 different PA structures

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吡咯里西啶類生物鹼　　Pyrrolizidine Alkaloids (PAs)

千里光次酸
necic acid(s)

千里光次鹼基
necine

吡咯里西啶類生物鹼

毒性
- 主要影響肝和肺
- 急性肝靜脈閉塞性疾病
  - ✓ 肝臟小靜脈受阻
  - ✓ 液體在腹腔積聚，肝臟增大
- 可導致慢性肝硬化

Pyrrolizidine Alkaloids (PAs)
Toxicity
- affect predominantly the liver and lung
- characterised by acute hepatic veno-occlusive disease
  - ✓ small veins in the liver are obstructed
  - ✓ accumulation of fluid in the peritoneal cavity, increased liver size
- chronic onset may lead to liver cirrhosis

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吡咯里西啶類生物鹼

致癌性

- 國際癌症研究機構(IARC)
  - ✓ 無流行病學資料顯示，攝入PAs與人患癌有關
  - ✓ 動物研究
    - ➤ 有些PAs呈現致癌性和基因毒性

Pyrrolizidine Alkaloids

Carcinogenicity

- International Agency for Research on Cancer (IARC)
  - ✓ no epidemiological data suggests a link of PA exposure and cancer in humans
  - ✓ animal studies
    - ➤ some PAs show carcinogenic and genotoxic effects

吡咯里西啶類生物鹼

國際癌症研究機構(IARC)
- 第2B組 (或可能令人類患癌)
- 第3組 (在會否令人類患癌方面未能分類)

Pyrrolizidine Alkaloids (PAs)

International Agency for Research on Cancer (IARC)
- group 2B (possibly carcinogenic to humans)
- group 3 (not classifiable as to its carcinogenicity to humans)

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膳食攝入來源

- 通過植物產品
  - ✓ 穀物或穀物產品（麵粉或麵包）
    - ➢ 含PAs的雜草的種子污染
    - ➢ 人類中毒事件
  - ✓ 茶產品、香料

Dietary exposures
- through plant products
  - ✓ grain or grain products (flour or bread)
    - ➢ contaminated with seeds from PA-containing weed
    - ➢ direct human cases of poisoning
  - ✓ tea products, spices

膳食攝入來源

- 從植物轉移到動物源性食物內
  - ✓ 蜂蜜、奶類、蛋類和動物內臟

Dietary exposures

- carry-over of plant PAs into food of animal origin
  - ✓ honey, milk, eggs and offal

膳食攝入來源

- 從蜂蜜攝入（歐洲食品安全局, 2011）
  - ✓ 有些蜂蜜含有高PAs水平
    - ➢ 蜂蜜攝入量高的幼兒和兒童
    - ➢ 可能存在健康問題

Dietary exposures to PAs
- exposure through honey (EFSA 2011)
  - ✓ some honey contain high levels of PA
    - ➢ for those toddlers and children who are high consumers of honey
    - ➢ a possible health concern

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膳食攝入來源

- 從茶產品攝入(德國聯邦風險評估所, 2013)
  - ✓ 有些茶產品含有高PAs水平
  - ✓ 成人和兒童
    - ➤ 長時間大量飲用
    - ➤ 可能存在健康問題

Source and exposures to PAs

- exposure through tea products (The German Federal Institute for Risk Assessment (BfR) 2013)
  - ✓ some tea products contain high levels of PAs
  - ✓ adults and children
    - ➤ frequently consume large amount
    - ➤ a possible health concern

吡咯里西啶類生物鹼

- 糧農組織/世衞組織食品添加劑專家聯合委員會(JECFA)
  - ✓ 膳食攝入量 ≤ 每日每公斤體重0.0182微克
    - ➢ 從公眾健康影響的角度
    - ➢ 關注程度低

Pyrrolizidine Alkaloids (PAs)

- JECFA
  - ✓ human exposure ≤ 0.0182 μg/kg bw/day
    - ➢ from public health point of view
    - ➢ low health concern

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方法和化學分析 Methodology and chemical analysis

食品組別 / Food group
穀類及穀類製品（小麥粉，大麥粉，黑麥粉，白麵包）/ Cereals and cereal products grains (wheat flour, barley flour, rye flour, white bread)
牛奶和奶製品(牛奶，奶酪，酸奶）/ Milk and milk products (milk, cheese, yoghurt)
蛋(雞，鴨) / Eggs (chicken, duck)
肉類和肉製品 (牛肉，牛肝，豬肉，豬肝，雞肉，雞肝）/ Meat and meat product (beef, cattle liver, pork, pig liver, chicken meat, chicken liver)
蜂蜜 / Honey
乾製香料 / Dried spices
茶葉 (已沖泡) / Tea leave (infusion)
茶飲料 / Tea beverage
總數 / Total

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方法和化學分析

選取的食物中

- 分析28個PAs的總和

Methodology and chemical analysis
Selected food items
- analysed the total sum of 28 PAs

28 PA(s)	
Echimidine	Echimidine N-oxide
Erucifoline	Erucifoline N-oxide
Europine	Europine N-oxide
Heliotrine	Heliotrine N-oxide
Intermedine	Intermedine N-oxide
Jacobine	Jacobine N-oxide
Lasiocarpine	Lasiocarpine N-oxide
Lycopsamine	Lycopsamine N-oxide
Monocrotaline	Monocrotaline N-oxide
Retrorsine	Retrorsine N-oxide
Senecionine	Senecionine N-oxide
Seneciphylline	Seneciphylline N-oxide
Senecivernine	Senecivernine N-oxide
Senkirkine	
Trichodesmine	

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方法和化學分析

- 分析結果與本地食物消費量相結合
  - ✓ 2005至2007年香港市民食物消費量調查

- ✓ （從膳食)PA攝入量一般的人
- ✓ （從膳食)PA攝入量高的人
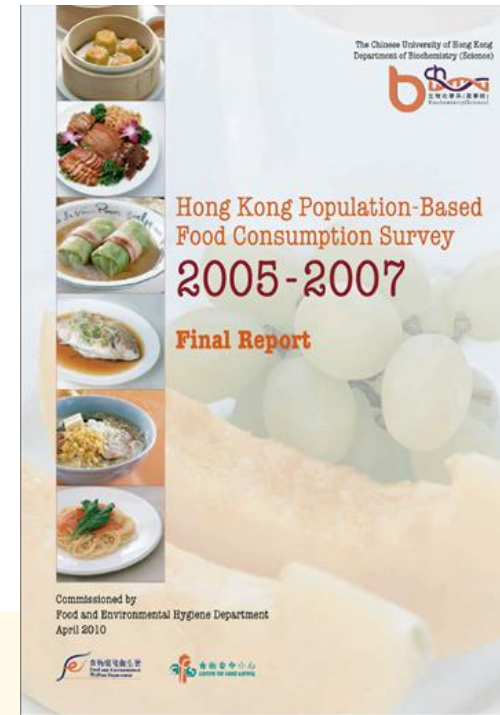
Methodology and chemical analysis

- results combined with local consumption information
  - ✓ Hong Kong Population-based Food Consumption Survey (2005-2007)

- ✓ average (PA dietary exposure) consumers
- ✓ high (PA dietary exposure) consumers

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結果與討論

- 234個樣品中，有118個含至少一種PA（50%）
- 118個樣品中，91個（77%）屬於
  - ✓ 蜂蜜，乾香料，茶葉(已沖泡)
- 所有"肉類和肉類產品"均低於檢測限

Results and discussion

- 118 out of 234 samples analysed with at least one PA (50%).
- 91 samples of 118 samples (77%)
  - ✓ honey, dried spices, tea leaves (infusion)
- all in "meat and meat products": < LOD

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結果與討論

膳食攝入量 ≤ 每日每公斤體重0.0182微克
- 市民健康所受的影響不大

	Average (PA dietary exposure) PA攝入量一般的人	High consumer (PA dietary exposure) PA攝入量高的人
每日膳食攝入總量 （微克/每公斤體重）（下限-上限） Dietary exposure (μg/kg bw/day)(LB-UB)	0.0003 – 0.0015	0.0015 – 0.0043

Results and discussion

human exposure ≤ 0.0182 μg/kg bw/day
- indicating a low health concern

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結果與討論

健康飲食的基本建議
- 應保持均衡及多元化的飲食
  - ✓包括進食各樣的水果和蔬菜
  - ✓避免因偏食某幾類食物而攝入過量污染物

Results and discussion

Basic dietary advice on healthy eating
- maintain a balanced and varied diet
  - ✓ includes a wide variety of fruit and vegetables
  - ✓ so as to avoid excessive exposure to any contaminants from a small range of food items

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結果與討論　　Results and discussion

食品組別 food group	樣本數目 number of samples	低於檢測限的樣本所佔百分比 % of samples < LOD	平均值(微克/公斤鮮重) [範圍] mean (µg/kg fresh weight) [range]			
			下限 LB		上限 UB	
蜂蜜honey	6	0	7.4	[0.21 – 16]	7.5	[0.31 – 16]
茶葉(已沖泡) tea leave (infusion)	48	50	0.33	[0 – 2.6]	0.46	[0.14 – 2.7]
乾製香料dried spices	82	26	300	[0 –11000]	300	[0.14 – 11000]

特色茶葉(已沖泡) specific tea leaves (infusion)	平均(微克/公斤)(上限) mean conc. (µg/kg) (UB)
路依保斯茶 rooibos tea	1.7
馬鞭草茶 verbena tea	0.87
薄荷茶 peppermint tea	0.44
甘菊茶 chamomile tea	0.43

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結果與討論　　　　　Results and discussion

特色茶葉(已沖泡) / tea leaves (infusion) 平均值(微克/公斤鮮重) [下 限 –上 限] mean (µg/kg fresh weight) (lower bound – upper bound)	
香港 Hong Kong	歐洲食品安全局 EFSA(2016)
路依保斯茶 rooibos tea	1.60 – 1.70	4.1 – 6.3
薄荷茶 peppermint tea	0.33 – 0.44	3.5 – 6.2
甘菊茶 chamomile tea	0.30 – 0.43	2.3 – 4.8

- 與ESFA報告相比，特色茶中的PAs水平明顯較低
- compared with ESFA report, the levels of PAs were significantly lower

- 預期對本地消費者的健康影響較低
- a lower level of health concern to local consumers was expected

結果與討論

乾製香料

- 乾製香料(次要成分)用量少
  - ➢ 估計不會佔PAs膳食攝入的重要部分

乾製香料 dried spices	平均(微克/公斤)(上 限) mean conc. µg/kg (UB)
孜然籽 Cumin Seed	1 900
牛至 Oregano	1 400
龍蒿 tarragon	1 100

Results and discussion

Dried spices

- used in small amounts as minor ingredients
  - ➢ estimated not a significant contribution of PAs to overall PAs dietary exposure

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結果與討論

盡量減低從膳食攝入這些物質
- 乾製香料和茶葉製造商
  - ✓ 查找污染產品的成因
  - ✓ 採取措施，從源頭防止和減少產品受這些物質污染
    - ➢ 參考食品法典委員會的《防止和減少食物及飼料受吡咯里西啶類生物鹼污染的除草守則》

Results and discussion

Dietary exposure to PAs should be as low as possible.
- Companies producing dried spices and tea leaves
  - ✓ identify the causes of contamination
  - ✓ undertake source-directed measures to prevent and reduce PA contamination
    - ➢ Code of Practice for Weed Control to Prevent and Reduce Pyrrolizidine Alkaloid Contamination in Food and Feed

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局限及不確定性

- 不能反映整個情況
  - ✓ 樣本數目不多(礙於化驗室資源有限)
- 僅反映採樣時,某些食品PA水平的情況
  - ✓ 不能反映批次間差異

Uncertainties and Limitations
- cannot reflect the actual situation
  - ✓ limited no. of samples analysed (limited lab resource)
- a snapshot of PAs in certain foods
  - ✓ cannot reflect batch to batch variations

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局限及不確定性

- 不同的PAs有不同的毒性
  - ✓現有數據不足以識別它們相對的毒性
  - ✓不能評估它們的組合效應
- 其它未分析的PAs
  - ✓ 缺乏這些PAs的標準品用作分析

Uncertainties and Limitations of the Study
- individual PAs differ in potency
  - ✓ insufficient data to identify their relative potency
  - ✓ evaluation of combined effects not possible
- other PAs not analysed
  - ✓ a lack of reference material for these PAs

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完
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