

香港首個總膳食研究： 二噁英和二噁英樣多氯聯苯

The First Hong Kong Total Diet Study: Dioxins and dioxin-like polychlorinated biphenyls (PCBs)



內容

Content

- 簡介總膳食研究
 - 香港首個總膳食研究
 - 研究目的及方法
 - 二噁英和二噁英樣多氯聯苯
 - 研究結果
 - 建議
-
- **Introduction to Total Diet Study**
 - **The First Hong Kong Total Diet Study**
 - Objectives & Methodology
 - **Dioxins and Dioxin-like PCBs**
 - Study Findings
 - **Recommendation**

總膳食研究

Total diet study (TDS)

- 在進行風險評估工作時，評估某種物質膳食攝入量的方法
 - 包括食物購買及處理、化驗分析、膳食攝入量評估
- **A tool for estimating dietary exposure, one of the steps in risk assessment**
 - Involves food sampling and preparation, laboratory analysis, dietary exposure estimation

總膳食研究 (二)

Total diet study (TDS) (2)

- 國際公認
 - 最具成本效益的方法評估不同人口組別從膳食攝入食物化學物或營養素的分量
- 為食物安全風險評估和食物供應規管提供科學基礎
- **Internationally recognised**
 - Most cost effective way to estimate the dietary exposure of various population for a range of chemicals or nutrients
- **Provide scientific basis for assessing food safety risks and regulating food supply**

總膳食研究 (三)

Total diet study (TDS) (3)

■ 總膳食研究有別於食物監察計劃

- 聚焦在整個飲食的情況，而不是個別食品
- 處理食物至可食用狀態
 - 考慮到烹飪的影響
- 評估市民實際從膳食攝入某種物質的分量，而不是食物中的某種物質的水平

■ TDS differs from food surveillance programme

- Focus on substances in the whole diet, not on individual foods
- Prepare foods as table-ready form
 - Take into consideration the impact of cooking
- Assess dietary exposure to substances actually ingested by the population, rather than concentrations of substances in food

香港首個總膳食研究

The First Hong Kong Total Diet Study

- 在2010年至2014年期間進行
- 研究目的:
 - 估計整體香港市民和不同人口組別從膳食攝入各種選定物質的分量
 - 包括污染物和營養素
 - 從而評估攝入這些物質對健康帶來的風險
- **Period: 2010 ~ 2014**
- Objectives:
 - To estimate the dietary exposures of the HK population and population subgroups to a range of substances
 - including contaminants and nutrients
 - To assess any associated health risks

香港首個總膳食研究 (二)

The First Hong Kong Total Diet Study (2)

■ 食物消費量數據

- 香港市民食物消費量調查
- 根據市民食物消費量模式，選出150種食物

■ Food consumption data source

- Population-Based Food Consumption Survey (FCS)
- Select 150 TDS food items, based on food consumption pattern

香港首個總膳食研究 (三)

The First Hong Kong Total Diet Study (3)

- 檢測超過130種物質
 - 殘餘除害劑(如有機磷除害劑)
 - 持久性有機污染物(如二噁英)
 - 金屬污染物(如無機砷)
 - 黴菌毒素(如黃曲黴毒素)
 - 主要營養素(如飽和脂肪酸)、元素(如鈉)等

- **Analysis of over 130 substances**

- Pesticide residues (e.g. organophorous pesticides)
- persistent organic pollutants (POPs) (e.g. dioxins)
- Metallic contaminants (e.g. inorganic arsenic)
- Mycotoxins (e.g. aflatoxins)
- Macronutrients (e.g. saturated fatty acids), elements (e.g. sodium), etc.

食物抽樣和處理

Food sampling and preparation

- 委託香港中文大學進行
 - 2010年3月至2011年2月期間分4次進行
- 每次抽樣工作為期約三個月
 - 為150種食物分別購買3個樣本
 - 把食物處理至可食用狀態
 - 把同一種食物的3個樣本合併成為混合樣本
- Commission the Chinese University of Hong Kong to carry out
 - 4 occasions from March 2010 to February 2011
- On each occasion (about three-month period)
 - Purchase 3 samples for each of 150 food items
 - Prepare food as table-ready form
 - Combine the 3 samples of the same item into a composite sample

食物抽樣和處理(二)

Food sampling and preparation (2)

- 合共收集1 800個樣本，並合併為600個混合樣本作化驗分析
- **A total of 1800 samples were collected and combined into 600 composite samples for laboratory analysis**

化驗分析

Laboratory analysis

- 主要由食物安全中心的食物研究化驗所進行
- 部分物質如二噁英的分析工作：
 - 由政府化驗所進行
- 分析工作按待測物質的性質和穩定性分批進行
- **Mainly conduct by the Food Research Laboratory (FRL) of the CFS**
- **Some substances such as dioxins:**
 - Conduct by the Government Laboratory
- **Perform in batches with reference to the nature and stability of the selected substances**

膳食攝入量評估

Dietary exposure estimation

- 採用由內部研發名為攝入量評估系統的網絡電腦系統進行
- 攝入量
 - 均數 → 一般人膳食攝入量
 - 在第95百分位的數值 → 膳食攝入量高的人
- Perform with the aid of an in-house developed web-based computer system, “EASY” (Exposure Assessment System)
- Exposure level:
 - Mean → average dietary exposure
 - 95th percentile → exposure for high consumers

Exposure Assessment System - Welcome Pag...

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Total Diet Study (TDS)	Risk Assessment for Supporting Standard Setting	Individual Chemical Hazard Assessment	Food Consumption Data Enquiry	System Maintenance
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研究報告

Study report

- 報告會分期公布
- 首份報告：
 - 二噁英和二噁英樣多氯聯苯
- Reports will be issued in phases
- First report:
 - **Dioxins and dioxin-like PCBs**

二噁英和二噁英樣多氯聯苯 Dioxins and dioxin-like polychlorinated biphenyls (PCBs)

- 列為斯德哥爾摩公約中的持久性有機污染物
- **Persistent organic pollutants (POPs)** covered by the Stockholm Convention

二噁英和二噁英樣多氯聯苯

Dioxins and dioxin-like PCBs

二噁英 Dioxins

多氯二苯並對二噁英
Polychlorinated dibenzo-para-
dioxins (PCDD)

多氯二苯並呋喃
Polychlorinated dibenzofurans
(PCDF)

二噁英樣多氯聯苯 Dioxin-like PCBs

毒理性質與二噁英相似的多氯
聯苯(PCB)
Polychlorinated biphenyls (PCBs)
exhibit toxicological properties
similar to dioxins

由於毒性和作用機制相近，通常作為同一類物質處理
Due to similarity in toxicity profiles and mechanisms of action, they
are generally considered together as a group

二噁英和二噁英樣多氯聯苯的來源

Sources of dioxins and dioxin-like PCBs

環境污染物

Environmental contaminants

-
- 二噁英**
Dioxins
- 自然現象產生、燃燒和工業製造的副產品
 - Occur naturally, by-products of combustion and industrial processes
-

- 多氯聯苯**
PCBs
- 電絕緣體等工業用途
 - 從70年代起，禁止使用
 - Industrial uses such as electrical insulators
 - Banned for use since 1970s
-

二噁英和二噁英樣多氯聯苯的來源(二)

Sources of dioxins and dioxin-like PCBs (2)

- 會長時間存留在環境，並在食物鏈中生物累積
- 主要攝入來源
 - 肉類、奶製品、蛋和魚等動物源性食品
- **Persist in the environment and bioaccumulate in the food chain**
- **Main route of exposure**
 - Foods of animal origin such as meat, dairy products, eggs and fish

對健康的影響

Health Effect

- 短期攝入大量對人體的影響
 - 導致氣瘰瘡的皮膚病
- 長期攝入對人體的影響
 - 免疫系統毒性、發育和發育中的神經系統的影響、對甲狀腺和類固醇激素的影響、生殖系統的影響
- **Short-term exposure** to high levels in human
 - Skin lesions known as chloracne
- **Long-term exposure** in human
 - Immunotoxicity, developmental and neurodevelopmental effects, and effects on thyroid and steroid hormones and reproductive functions

對健康的影響(二)

Health Effect (2)

■ 致癌性

□ 國際癌症研究機構(IARC)

- 2,3,7,8-四氯二苯並對二噁英(TCDD)

- 2,3,4,7,8-五氯二苯並呔喃

- 多氯聯苯 126

- 列為第1組物質 (即確定的人類致癌物)

■ Carcinogenicity

□ International Agency for Research on Cancer (IARC)

- 2,3,7,8-tetraCDD (TCDD)

- 2,3,4,7,8-pentaCDF

- PCB 126

- Group 1 agent, i.e. carcinogenic to human

安全參考值

Safety reference value

- 暫定每月可容忍攝入量 (PTMI) [JECFA (2001)]
 - 每月每公斤體重 70皮克毒性當量(TEQ)
 - 包括PCDD、PCDF和二噁英樣多氯聯苯
- Provisional tolerable monthly intake (PTMI) [JECFA (2001)]
 - 70 pg TEQ/ kg bw/ month
 - for PCDDs, PCDFs and dioxin-like PCBs

JECFA:

- 聯合國糧食及農業組織 / 世界衛生組織聯合食品添加劑專家委員會
- Joint Food and Agriculture Organization/ World Health Organization Expert Committee on Food additives

■ 1皮克 = 一萬億分之一克 (1×10^{-12} 克)

■ 1 pg (picogramme) = one million millionth of a gramme (1×10^{-12} g)

安全參考值(二)

Safety reference value (2)

■ 毒性當量(TEQ)的數值

- 根據世界衛生組織(2005年)所定的毒性當量因子(TEF)計算出來的
- TEF
 - 包括29種二噁英同系物
 - 與毒性最強的二噁英同系物(TCDD)的毒性相比

■ TEQ value

- Compute using the toxic equivalency factors (TEFs) established by WHO (2005)
- TEFs
 - Assign to 29 congeners
 - By comparing their toxicities relative to the most toxic one (TCDD)

研究結果

Results

- 從150種食物，選取其中71種
 - 主要是動物源性食物及其產品、油脂性食物
- 從4次抽樣中，分析其中2次抽樣的食物
- 共檢測了142個混合樣本

- **71 food items out of 150 food items**
 - Mainly foods of animal origin and their products and oily food
- **2 occasions out of 4 occasions**
- **Totally analysed 142 composite samples**

研究結果(二)

Results (2)

- 66%的二噁英和二噁英樣多氯聯苯的同系物含量在檢測限之上
- Detected in 66% of test results

含量最高的食物

Food items with highest levels

含量 (皮克TEQ/克)

Concentration (pg TEQ/g)

桂花魚 Mandarin fish

1.056

蠔 Oyster

0.926

鯧魚 Pomfret fish

0.885

膳食攝入量

Dietary Exposure

每月膳食攝入量 (皮克TEQ/公斤體重)
Dietary exposure (pg TEQ/kg bw/month)

	一般人 Average	攝入量高的人 High consumer
本研究 Current study	21.92	59.65
% PTMI	31.3	85.2

- 攝入量均低於PTMI
- 一般市民的健康受到二噁英和二噁英樣多氯聯苯嚴重不良影響的機會不大

- Exposures were below the PTMI
- General population was unlikely to experience major undesirable health effects of dioxins and dioxin-like PCBs

膳食攝入量與 PTMI 之比較

Comparison between dietary exposure & PTMI

■ PTMI

- 是指人體終生每月可攝入某一化學物而不致構成顯著健康風險的估計分量
- 著眼於終生攝入量

■ 攝入量即使超出PTMI，並不表示健康一定會受損

■ 如果攝入量只是偶然高於PTMI 而其平均攝入量並非持續不斷超出此水平，也不會影響健康

■ PTMI

- An estimate of the amount of a chemical that can be ingested over a lifetime without appreciable risk
- Emphasis of PTMI is a lifetime exposure

■ An intake above the PTMI does not automatically mean that health is at risk

■ Transient excursion above the PTMI would have no health consequences provided that the average intake over long period is not exceeded

跟過往本地研究比較

Comparison with previous local study

每月膳食攝入量 (皮克TEQ/公斤體重)
Dietary exposure (pg TEQ/kg bw/month)

一般人
Average

攝入量高的人
High consumer

研究(2002年)(中學生)

25.5

62.1

Study (2002)

(PCDD/PCDF)

(PCDD/PCDF)

(Secondary school student)

本研究 (成人)

21.92

59.65

Current study (Adults)

(PCDD/PCDF & **PCB**)

(PCDD/PCDF & **PCB**)

本研究

- 評估更全面
- 包括二噁英樣多氯聯苯的攝入量

Current study

- More comprehensive
- Include dioxin-like PCBs in exposure estimation

跟其他地方研究比較

Comparison with other places

地方 Places	每月膳食攝入量 (皮克TEQ/公斤體重) Dietary exposure (pg TEQ/kg bw/month)	
	一般人 Average	攝入量高的人 High consumer
美國 USA	18.2 ^{a b c}	
澳洲 Australia	15.6 ^{a d}	40.6 (95P) ^{a d}
香港 Hong Kong (本研究) (Current study)	21.92^c	59.65 (95P)^c
日本 Japan	25.2 ^e	
英國 UK	27 ^{a d}	51 (97.5P) ^{a d}
中國 China	4.5 – 28.8 ^{a d}	
荷蘭 Netherlands	39 ^e	
芬蘭 Finland	55.5 ^{a d}	
瑞典 Sweden	56.1 ^{a d}	

a WHO TEF 1998

c 中位數估量 Median bound

e 下限估量 Lower bound

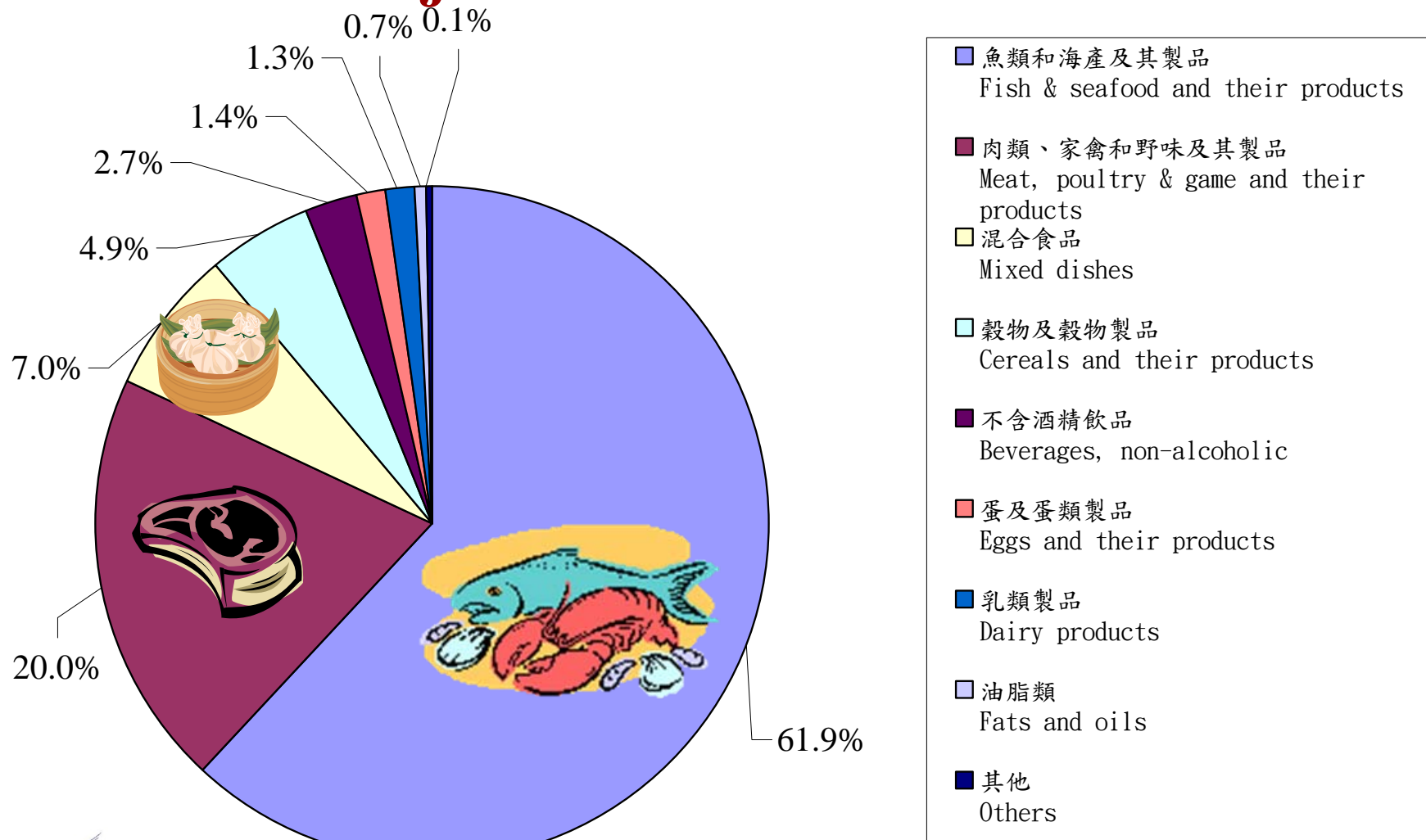
b PCDD/PCDF

d 上限估量 Upper bound

27

主要的膳食來源

Major food contributors



- 跟其他的膳食攝入量評估研究相若
- Similar to other dietary exposure studies

主要的膳食來源 (二)

Major food contributors (2)

- 魚類及其製品

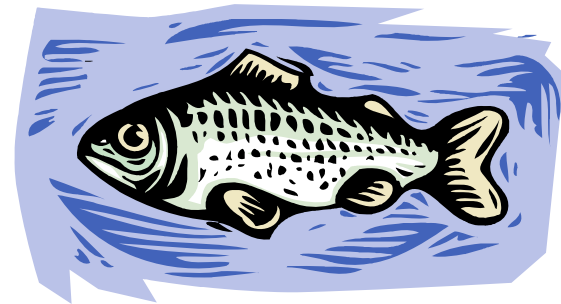
- 佔總攝入量的55.6%

- 最主要的膳食來源

- Fish and fishery products

- 55.6% of total exposure

- Significant source of exposure



結論

Conclusion

- 一般市民
 - 健康受到二噁英和二噁英樣多氯聯苯嚴重不良影響的機會不大
- 主要攝入來源：
 - 動物源性的食物
 - 特別是魚類、肉類和家禽
- **General population**
 - **unlikely to experience major undesirable health effect**
- **Predominant route of exposure:**
 - **Food of animal origin**
 - **Particularly fish, meat and poultry**

結論(二) Conclusion (2)

- 各界應致力減少市民從膳食攝入二噁英和二噁英樣多氯聯苯的分量
- **Effort should be made to reduce the dietary exposure to dioxins and dioxin-like PCBs of the population**

預防和減少人類的攝入量

Prevention and reduction of human exposure

- 應採取源頭控制措施
- 減少二噁英的排放和對食物造成的污染
 - 國際社會的努力是十分重要
- 食品法典委員會的實務守則(2006)
 - 在預防措施方面，給國家機構、農民、飼料和食品製造商提供指引
- **Through source-directed measures**
- **Reduction of dioxin emission and their subsequent contamination of food**
 - **International efforts are essential**
- **Codex Code of Practice (2006)**
 - Gives guidance to national authorities, farmers, and feed and food manufacturers on preventive measures

給市民的建議

Advice to public

- 去掉肉類的脂肪
- 食用低脂奶製品
- 保持均衡及多元化的飲食
 - 包括進食多種蔬果
 - 避免因偏食某幾類食物而攝入過量的污染物
- **Trim fat from meat**
- **Consume low fat dairy**
- **Have a balanced and varied diet**
 - includes a wide variety of fruit and vegetables
 - so as to avoid excessive exposure to contaminants from a small range of food items

給市民的建議(二)

Advice to public (2)

- 宜適量進食多種魚類
 - 魚類含有多種人體所需的營養素，例如奧米加-3脂肪酸、優質蛋白質等
- **Recommend moderate consumption of a variety of fish**
 - Fish contain many essential nutrients such as omega-3 fatty acids, and high quality proteins

公佈 Publicity

- 二噁英和二噁英樣多氯聯苯研究報告
 - 將會上載食物安全中心網頁
- 其他總膳食研究報告
 - 亦會陸續上載食物安全中心網頁
- Study report on dioxins and dioxin-like PCBs
 - Will be uploaded in the webpage of CFS
- Other TDS reports
 - Will be released in phases and uploaded in the webpage of CFS

謝謝
Thank you