Potential Risk of *Listeria* in Refrigerated Foods with Long Shelf Life

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Listeriosis

- **A primarily foodborne disease caused by *Listeria monocytogenes (LM)***
  - **Most healthy people: asymptomatic or have only flu-like symptoms**
  - **Pregnant women: miscarriage or stillbirth, or her newborn resulting in septicaemia or meningitis**
  - **Elderly and immunocompromised individuals: septicaemia and meningitis**

- **An increasing trend of reported listeriosis in Hong Kong in recent years is noted**

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Listeria monocytogenes

- **Universally found in the environment**
  - **low levels of *LM* in food (e.g. < 100 cfu/g) pose very little risk to consumers**

- **Can be killed under normal cooking temperature and cannot grow at frozen temperature**

- **Unlike other food poisoning bacteria, it may continue to grow slowly at refrigerated temperature as low as 0˚C**

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Refrigerated Foods with Long Shelf life

- **Long shelf life (greater than five days) refrigerated (excluding frozen) ready-to-eat foods are potential high risk items for listeriosis**
  - **E.g. cheese, smoked seafood, processed meat, salad**

- **Prolonged storage in refrigerator may allow *LM* to have sufficient time to grow gradually to exceed 100 cfu/g throughout the shelf life**

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Refrigerated Foods with Long Shelf life

- **The growth of *LM* in ready-to-eat food can be controlled by various approaches**
  - **Formulation e.g. pH, Aw**
  - **Basic cleaning and disinfection programmes**
  - **Temperature**
  - **Shelf life etc.**

- **Some refrigerated food with long shelf life may have adopted these measures to control the growth of *LM***

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Study on High Risk Foods

- **Objectives: To assess the microbiological quality, particularly the level of *LM*, of prepackaged long shelf life refrigerated products at the end of shelf life**

- **Sampling period: Mid-September 2013 to February 2014**

- **100 ready-to-eat samples (cheese, smoked seafood, processed meat and salad)**

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Laboratory analysis

- Samples were stored in a monitored laboratory refrigerator (4±3°C) until they were ready for testing, i.e. within the week which the sample expired

- Food Safety (If "Unsatisfactory", potentially injurious to health and/or unfit for human consumption)
  - *Listeria monocytogenes* count

- Hygienic quality
  - Aerobic colony count (ACC) and *Escherichia coli* count
  - Results in this study expressed as colony-forming unit or most probable number

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Aerobic colony count (ACC)

- **Total number of bacteria found in food; includes those naturally occur and those as a result of contamination**

- **A quality but not safety indicator**
  - High level of ACC does not indicate an immediate risk to public health; however, it may indicate a sub-optimal hygienic conditions and further improvement on the hygienic conditions is required

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Escherichia coli

- **A commonly used surrogate indicator to reflect the hygienic quality of food**
- **Indicates direct or indirect faecal contamination**
- **Substantial number in food suggests a general lack of cleanliness in handling and improper storage**

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Data analysis

- **In general, the results were compared against the respective criteria set out in the local "Microbiological Guidelines for Food" effective in August 2014**
  - ***E. coli* in cheese (made from raw milk) and *LM* in samples: Referred to other criterion for study purpose**

Study Results

Listeria monocytogenes criterion (for this study)

- **This study aims to assess if there is any outgrowth of *LM* in the samples at the end of shelf life, the *LM* count in each sample was analysed**
  - **"Unsatisfactory: Potentially injurious to health and/or unfit for human consumption" if the *LM* count is greater than 100 cfu/g**

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Results – *Listeria monocytogenes* count

- None of the samples contained excessive *LM* i.e. the count in all samples (n=100) were <20 cfu/g

ACC criteria (for this study)

Food category	Microbiological quality Result (colony-forming unit (cfu/g))		
	Satisfactory	Borderline	Unsatisfactory
Aerobic colony count (ACC) [30°C/48 hours]			
8. Extended shelf life food products requiring refrigeration Smoked seafood and process meat samples	$<10^6$	10^6-$<10^8$	$\geq 10^8$
12. Fresh fruit and vegetables, products containing raw vegetables Salad samples	Not applicable		
13. Fermented, cured and dried meats, fermented vegetables, ripened cheeses Cheese samples	Not applicable		

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Results – ACC (I)

- **48/ 56 (86%) samples contained ACC <10^8 cfu/g at the end of shelf life**

- **A smoked fish and 7 processed meat samples contained ACC ranged from $1.7 \times 10^8 – 3.9 \times 10^8$ cfu/g**

	Microbiological results (cfu/g)		
	Satisfactory	Borderline	Unsatisfactory
	<10^6	10^6- <10^8	≥10^8
Smoked seafood (n=28)	16	11	1
Processed meat (n=28)	17	4	7

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Results – ACC (II)

- It is expected that samples analysed at the end of shelf life, their ACC may approach the upper "borderline" limit

- Excessive ACC found in the concerned samples indicated possible post-processing contamination e.g. during slicing and/or the length of time and temperature control in storage or facilitates was inadequate to prevent bacterial growth

E. coli criterion (for this study)

	Microbiological quality Result (cfu/g)		
	Satisfactory	Borderline	Unsatisfactory
***Escherichia coli*#**	<20	20 - $\leq 10^2$	$>10^2$

- ***E. coli* criterion for ready-to-eat food in general does not apply to cheeses made from raw milk; low levels of *E. coli* may be present in raw milk**
- **UK HPA survey (2012) suggested establishing microbiological criteria including *E. coli* for raw milk cheeses, with the proposed level of *E. coli*≥100/g**
- **# In this study, the microbiological quality of cheese made from raw/ unpasteurised milk is considered unsatisfactory if the *E. coli* level was greater than 100 cfu/g**

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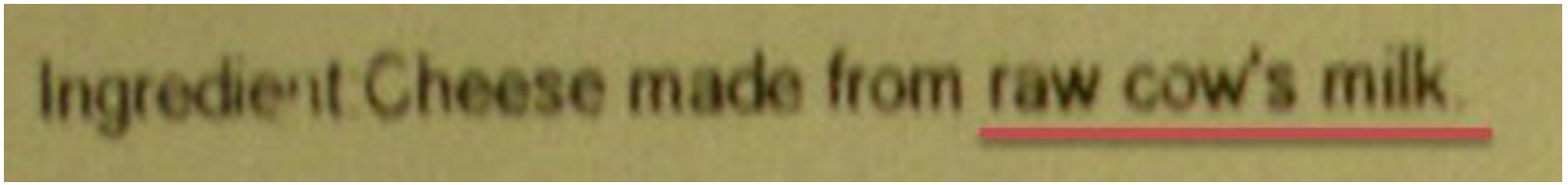
Results – *E. coli* count (I)

- **All samples (n=100), except 3 Camembert cheeses, contained *E. coli* count < 20 cfu or MPN/g**
  - **Excessive *E. coli* in product might be due to the use of raw milk contaminated with *E. coli***

- **1 contained *E. coli* count at 240 MPN/g**



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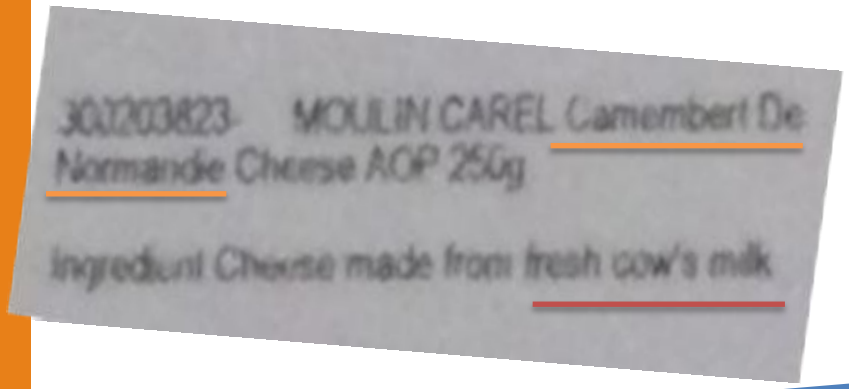
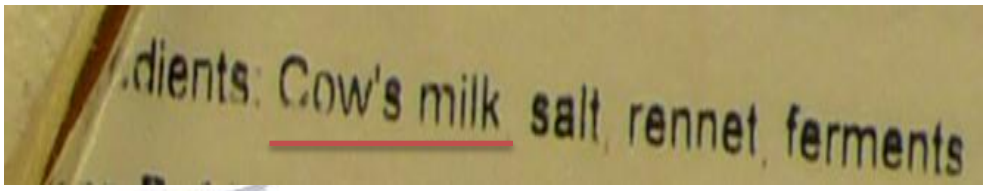
Results – *E. coli* count (II)

- **2 contained *E. coli* count > 1,100 MPN/g , but the information on the ingredient list may not clearly indicate the use of raw milk**



→ EU: 'Camembert de Normandie' is a lightly-salted soft cheese made from raw milk of Normande cows



Information available from Manufacturer's website:

Camembert made from **raw cow's milk** produced in a **small dairy**.

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Cheeses made from raw milk

- Raw milk can harbour pathogens that can pose serious health risks to consumers; no person shall sell for human consumption any milk or any milk beverage which has not been heat-treated (Cap. 132AQ)
  - does not apply to cheese made from raw milk
- During the production of raw milk Camembert cheese, no specific step has been introduced for the inactivation of microorganisms
- Important for the susceptible population to avoid consuming relevant products made from raw milk by making informed food choices

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Labelling of cheeses (from pasteurised milk or raw milk)

Information provided on label	Number of samples
Pasteurised milk or microfiltered milk	16
Raw milk or unpasteurised milk	4
Milk	7
Fresh milk	1
Total	28

Food and Drugs (Composition and Labelling) Regulations (Cap.132W): prepackaged food shall be legibly marked or labelled with a list of ingredients

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Follow up actions

- **Samples with unsatisfactory microbiological quality –**
  - **Unsatisfactory hygienic quality**

- **This indicates a need for improvement on the food production and processing**

- **The CFS gave health advice to relevant premises and took follow-up samples; all follow-up samples were satisfactory**

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Limitations

- Only 100 prepackaged long shelf life refrigerated ready-to-eat samples were taken, covering selected types of products
- Non-prepackaged products were not covered in this study
- Samples were stored in a monitored laboratory refrigerator at 4±3°C, which may be different from those at home
- Laboratory analysis was conducted within the week which the sample expired, but not exactly on the expiry date

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Conclusions

- None of the samples contained excessive *LM*
- Majority (89%) of the samples was of satisfactory or borderline microbiological quality at the end of shelf life
- Samples with unsatisfactory quality were due to excessive ACC or *E. coli* count (Both are quality but not safety indicators)
  - Indicate a need for improvement on the food production and processing
  - Three cheeses samples with high *E. coli* count : This might be due to the use of raw/ unpasteurised milk contaminated with *E. coli*

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Advice to public

- **Read food labels carefully to make informed food choices**
- **Follow the storage instructions e.g. "keep in a refrigerator" provided by the manufacturer and avoid cross-contamination**
- **Do not use food after the "use by" date as shown on the food label**

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Advice to susceptible populations including pregnant women, the elderly and immunocompromised individuals

- **Avoid high risk foods especially refrigerated ready-to-eat foods with long shelf life**
- **Choose cheeses carefully before consumption**
  - Hard and extra hard cheeses are generally safe
  - Avoid soft cheeses such as Feta, Brie, Camembert, blue cheeses (e.g. Danish blue, Gorgonzola and Roquefort)
  - For other types of cheeses, choose only those made from pasteurised milk
  - Do not eat if in doubt
- **Cook food thoroughly and consume cooked food promptly after cooking**

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Advice to trade

- Maintain good food and personal hygiene at all food processing stages
- Provide an adequately refrigerated environment (at or below 4˚C) throughout the supply chain
- Provide sufficient information on food label for the consumers to make informed food choices, e.g. indicating raw/ unpasteurised or pasteurised milk used for making cheese products
- Ensure all information provided on food label complies with the legal requirements

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For further information

- **Risk Assessment Study report**
  - http://www.cfs.gov.hk/english/programme/programme_rafs/programme_rafs_fm_01.html

- **Food Safety Information: *Listeria monocytogenes* in Cheese Products published in *Food Safety Focus***
  - http://www.cfs.gov.hk/english/multimedia/multimedia_pub/files/FSF94_2014_05_21.pdf

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Thank you

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