

Risk Assessment Studies
Report No. 6

**MICROBIOLOGICAL RISK
ASSESSMENT OF SIU-MEI
AND LO-MEI
IN HONG KONG**

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Abstract

Siu-mei and lo -mei are specially processed meat, poultry and offal products in Chinese cuisines. By definition, siu -mei would have been roasted at temperature over 200 °C in the preparation. Lo -mei are braised and soaked in large volume of seasoning sauce for a period of time for flavour enrichment. In both, roasting and cooking are the critical steps to destroy the microorganisms present in raw food. However, microbiological hazards might be introduced after heat treatment. Physical properties, namely pH value, salinity value, water activity, nutrient value, and the ambient environment such as relative humidity, temperature and gaseous atmosphere, are factors influencing the microbial growth in siu-mei and lo -mei. In 2000, out of the total 596 samples, the overall unsatisfactory rate of hygienic quality was 2.2% and the unsatisfactory rate of pathogenic contamination was 0.8%. The hygienic quality of siu -mei was better at an unsatisfactory rate of 1% (4 out of 406 samples), as compared with 4.7% (9 out of 190 samples) of lo -mei. As far as specific pathogens were concerned, *Salmonella* spp. was found in 2 siu -mei (roasted pork and BBQ pork) and 1 lo-mei (steamed plain chicken); *S. aureus* was found in 1 siu -mei (BBQ pork) and in 1 lo -mei (steamed plain chicken). Post contamination and prolonged storage at ambient temperature might be the main contributing factors.

Microbiological Risk Assessment of Siu-mei and Lo-mei in Hong Kong

INTRODUCTION

Siu mei and lo mei (燒味鹵味) are general terms covering a wide range of processed meat and poultry products in the Chinese cuisines. They are often treated as a group and considered high-risk items in terms of microbiological risks. However, upon closed examinations, it is identified that their characteristics are very different.

Objective

2. This paper evaluates the microbiological hazards associated with consumption of siu -mei and lo -mei, examines the local food surveillance findings for the period of 2000 , identifies the critical control points in the manufacturing practices and recommends improvement measures to the trade.

Definitions

3. Though a traditional Chinese food originated from Guandong, there is no documented definition for the terms “siu-mei” and “lo-mei”. A review on

their generic production procedures and way of consumption provides some insights on the classification. The following definitions are suggested and used in this paper.

4. Siu-mei is a group of meat products that has been roasted at a temperature of 200°C or above. Pork and poultry meat are often used for manufacturing siu-mei. Examples include roasted duck (燒鴨), roasted goose (燒鵝), roasted pork (燒肉、燒豬、燒排骨) and BBQ pork (燒).

5. Lo-mei is the foodstuff that has been soaked or immersed in large volume of seasoning sauces prior to cooking. Some lo-mei items may be braised again after cooking and/or at the time of serving. Food groups that are commonly used to produce lo-mei include poultry meat (貴妃雞、豉油雞、鹵水鵝、鹵水雞及雞翼), red meat (鹵水牛) and offal products (雞腸、鵝腸、生腸).

Legal provision

6. Siu-mei and lo-mei are classified as restricted food under Schedule 2 of the Food Business Regulation of the Public Health and Municipal Services Ordinance, Cap. 132. Manufacturing and sale of siu-mei and lo-mei in Hong Kong are subject to licensing control. A specific licence or endorsement must be obtained for the siu-mei and lo-mei business.

7. As of March 2001, some 1,700 food premises are allowed to sell siu-mei and lo-mei. The operators should comply with and observe the relevant licensing requirements and conditions, and maintain their premises at satisfactory hygienic

conditions. These licensing requirements and conditions basically require the vendors to put in place appropriate hygienic measures in the establishment for proper handling of food. For instance, there should be separate food preparation tables for siu-mei and lo -mei. The finished products should be displayed in an isolated showcase for sale. In addition, hand -washing facilities including soap and clean water supply should be provided for the food handlers. Health inspectors carry out regular checks to monitor compliance to these licensing requirements and conditions.

MANUFACTURING PRACTICE OF SIU MEI AND LO MEI

8. The key steps of preparing siu -mei and lo -mei are illustrated in the schematic diagrams at Figure 1 and 2 respectively. The raw ingredients of siu-mei are either fresh or frozen meat or poultry. They have to undergo pre-roasting preparation including defrosting, washing, marinating, and even pre-cooked. Roasting is the critical step to cook siu -mei products . At a temperature of 200 °C or above, almost all microbiological hazards would be eliminated. The products are then cooled, delivered and displayed for sale.

9. As for lo-mei, the main step involved is the use of marinade to impart the special taste and texture of meat and offal . The meat and offal are first cooked with seasoning sauce or water, and then braised in the sauce for a period of time to enrich their flavour . The finished products can be served hot or cold. If it is served cold, chilling should take place at the time of braising. Pig knuckle (熏蹄) is an example of lo -mei served cold.

MICROORGANISMS OF PUBLIC HEALTH CONCERN

10. Some microorganisms, such as *Campylobacter* spp., *Salmonella* spp., *Clostridium botulinum*, *Clostridium perfringens* and *Bacillus cereus*, are the normal floras naturally present in raw meat and offal (1). Some could also be introduced during food preparation, such as *Staphylococcus aureus*. However, whether such organisms may persist in siu -mei and lo -mei is the combined results of the physical properties of siu -mei and lo -mei and the ambient environment.

Physical Properties of Siu -mei and Lo -mei

11. Nature of food plays key role in affecting activities of the microbes, like growth, stasis and death (2). The most important physical properties that can affect microbial growth in food are pH value, salinity value (salt content), water activity (a_w) and nutrient value. There is scarce documentation about these properties of siu -mei or lo -mei in the literature. However, basing on the understanding of the food preparation steps of siu -mei and lo -mei, it is recognized that most of them have relatively high salinity level and low water activity as compared with other meat and poultry products. One study conducted by the Department of Health Services in the State of California, USA in 1990 reported that the water activity (a_w) of skin of roasted pig was low at a range of 0.72 to 0.81 (3). Low water activity would put some microorganisms at a competitive disadvantage and have difficulties to grow. Such inherent properties offer some protective effects to siu -mei and lo -mei against microbiological

hazards.

Environmental Factors

12. In addition, the characteristics of the ambient environment, including relative humidity, temperature and gaseous atmosphere, can influence the growth of microorganisms (2, 4). Water activity in food could be increased when placed in an environment with a high relative humidity. In addition, warm storage temperature, such as room temperature, is the other factor affecting the bacterial levels. All these contribute to a favourable environment for microbial growth.

MICROBIOLOGICAL QUALITY OF SIU-MEI & LO-MEI IN HONG KONG

13. The Food and Environmental Hygiene Department has conducted a surveillance on siu -mei and lo -mei available on the market for microbiological risk assessment. All samples are assessed for the hygienic quality and pathogenic contamination. The results of 2000 are analyzed and compared with the Department's Microbiological Guidelines for Ready -to-eat Foods. The unsatisfactory microbiological criteria for siu -mei and lo -mei are shown in Annex 1.

14. A total of 596 samples were taken for microbiological examinations. Of these, 406 (68%) and 190 (32%) samples were siu -mei and lo -mei respectively. Details are shown in Table 1.

Hygienic Quality

15. The hygienic quality of siu -mei was better as compared with lo -mei. The unsatisfactory rate for siu -mei was lower at 1% as compared with lo -mei which was at 4.7%. Of the 13 unsatisfactory samples, nearly 70% were lo-mei. They were steamed plain chicken (3 samples), pig knuckle (2 samples), cooked chicken (1 sample), red meat (1 sample), lo shuo goose (1 sample), and duck gizzard (1 sample). The remaining ones were siu -mei samples including 2 roasted pork , 1 BBQ pork and 1 mixed dish of rice with chicken and BBQ pork.

Presence of specific Pathogens

16. Of the 406 siu -mei samples examined, 3 samples (0.7%) were found to contain unsatisfactory level of pathogens. *Salmonella* spp. was present in 1 roasted pork and 1 BBQ pork. In addition, excessive amount of *S. aureus* was detected in another BBQ pork sample.

17. Of the 190 samples of lo -mei tested, 2 samples (1.1%) were found to contain unsatisfactory amount of pathogens. Two steamed plain chickens were found unsatisfactory due to presence of *Salmonella* spp. in a sample and excessive amount of *S. aureus* in the other.

DISCUSSIONS

18. Comparing the hygienic quality of siu-mei and lo -mei, the unsatisfactory rates of lo -mei were obviously higher than that of siu-mei. There were two

possible reasons. First, the quality of lo -mei seasoning sauce from different food premises may vary a lot and some may provide favourable medium for microbial growth due to prolonged storage time. Second, lo -mei would have higher water activity as it is soaked in a sauce for a longer time. This may flavour the microbial growth.

19. Of all lo -mei products, the hygienic quality of steamed plain chicken was relatively poorer. Inadequate cooking, improper handling and poor personal hygiene might be the main contributing factors. In general, steamed plain chicken is usually not thoroughly cooked and displayed at ambient temperature for a long period of time. Before consumption, reheating is commonly not applied at all.

20. Of all samples taken in 2000, two specific pathogens, unsatisfactory level of *Salmonella* spp. and *S. aureus* were isolated in the food samples. Both bacteria can be readily destroyed by heat treatment. The steps of roasting and cooking in siu -mei and lo -mei production could have eliminated these microbiological hazards theoretically. Post -heat treatment contamination was the most likely reason for introduction of such microbiological hazards from the environment, other raw or cooked food and food handlers to siu -mei and lo -mei products. *Salmonella* spp. is commonly transmitted due to poor food and environmental hygiene. *S. aureus* is the normal flora found in hands and noses; and poor personal hygiene is the main concern.

21. To further improve these situations, we have identified the following handling practices at siu -mei and lo -mei shops that might have contributed to introduction of microbiological hazards:

- (a) siu -mei and lo -mei are often stored at room temperatures within the danger zone of 4-63°C, which are warm beds for growth of micro-organisms;

- (b) they are often handled by bare hands, and occasionally the same staff may handle siu -mei and lo -mei products with other foodstuffs and cash;
- (c) leftover without adequate reheating may be sold; and
- (d) to attract customers, some vendors defy the sanitary requirement and expose siu-mei and lo -mei in open air without cover.

22. Among the above, improper handling procedure and sub-optimal storage conditions could be the main factors contributing to the introduction and perpetuation of specific pathogens. To improve the situation, application of HACCP principles in manufacturing practices is the key to successful microbiological risk management.

CONCLUSION AND RECOMMENDATIONS

23. Siu-mei and lo -mei are two distinct types of food preparation. Roasting and cooking are the critical steps in the production to destroy the bacteria. This study showed that the hygienic quality of lo -mei is less satisfactory than siu -mei, especially the steamed plain chicken. For pathogenic contamination, *Salmonella* spp. and *S. aureus* are the organisms of concern. Post-heat treatment contamination is the main route to introduce microbiological hazards. In addition, prolonged storage time at ambient temperature is favourable for the microbial growth. In view of these, we recommend the application of HACCP-based safety plan to control siu -mei and lo -mei.

24. The following critical control measures at the key steps of preparation are recommended to the trade.

(a) Purchasing

- Buy raw materials from such as raw meat and offal from approved and reliable sources.
- Inspect the incoming goods and documents before acceptance to verify that there is no sign or indication of contamination or damage to the goods.
- Appropriate and clean vehicles should be used to transport the siu-mei and lo-mei. During transportation, siu-mei and lo-mei should be properly protected to avoid cross contamination.

(b) Preparation

- Raw and cooked meats should be handled with separate utensils to avoid cross contamination.
- The demand of siu-mei and lo-mei should be carefully estimated to avoid over-production. This can prevent prolonged storage duration of siu-mei and lo-mei displayed at ambient temperatures.
- Observe good personal hygiene. Refrain from smoking, eating or playing with their hair during preparation. Open wound should be covered.
- Wash hand thoroughly with soap and water before and after handling siu-mei and lo-mei.
- Siu-mei and lo-mei should be thoroughly cooked.

(c) Display and Storage

- Store raw and cooked meats separately.
- Siu-mei and lo-mei should be stored and displayed in an insect- and dust-proof showcase.
- Food, other than siu-mei and lo-mei, especially raw food such as

seafood and Chinese preserved sausage, should not be stored in showcase for siu-mei and lo -mei.

- Equipment including trays, towels, chopping boards and knives should be maintained at hygienic conditions and regularly cleansed or regularly.
- Different staff should be deployed for handling cash and food.

26. Consumers are advised to take note of the following as food safety measures.

- (a) Patronize clean and well-maintained food premises
- (b) Observe whether food handlers follow good personal hygiene. They should not be smoking, playing with their hair or have any open wounds
- (c) Observe whether the siu-mei and lo-mei are covered or displayed in insect- and dust-proof showcase
- (d) Observe whether raw food is placed in the siu-mei and lo -mei showcase
- (e) Consume siu-mei and lo -mei as soon as possible
- (f) Store the leftover in a refrigerator and reheat them thoroughly before consumption

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Figure 1: Flow diagram of siu-mei production

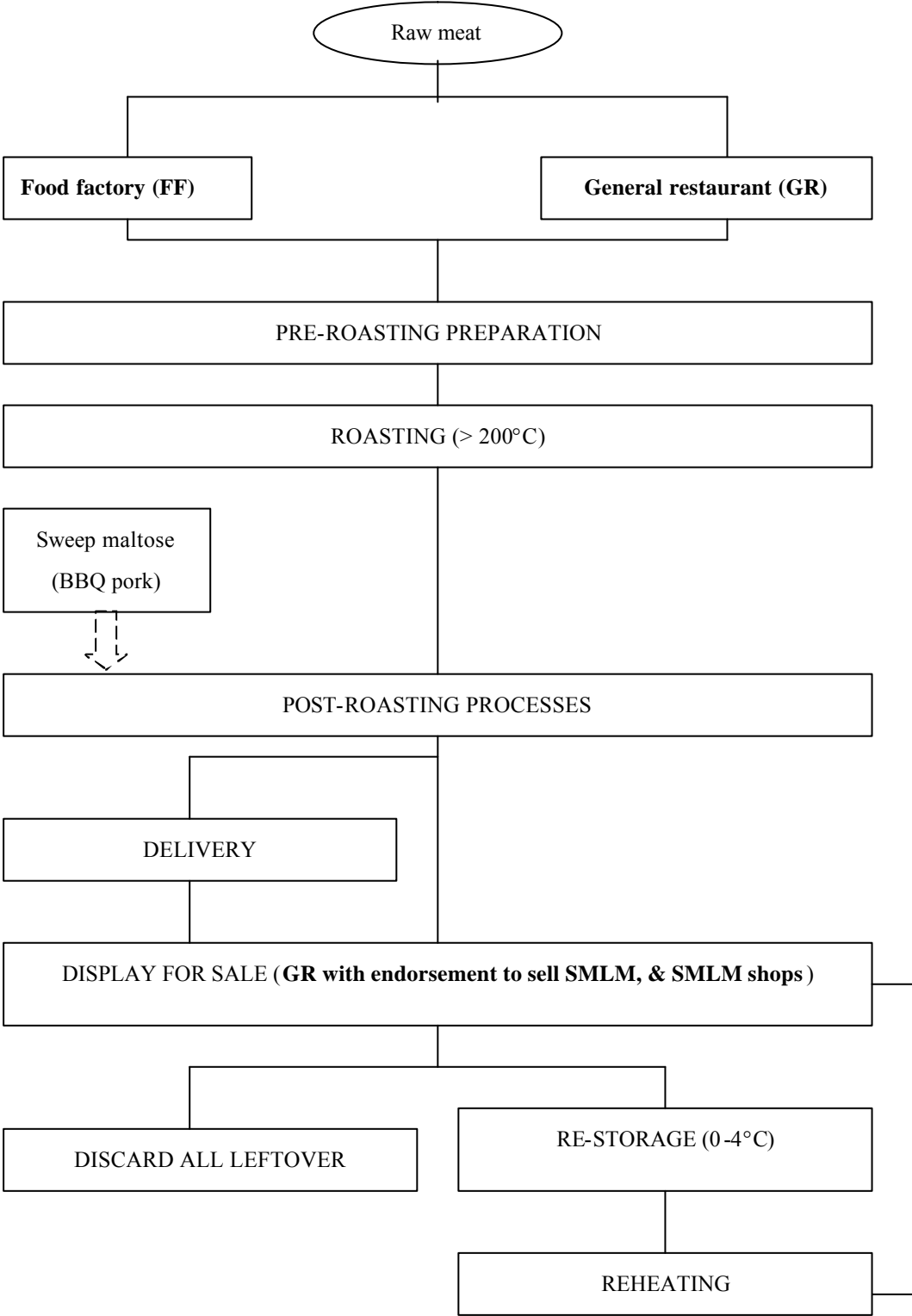


Figure 2: Flow diagram of lo -mei production

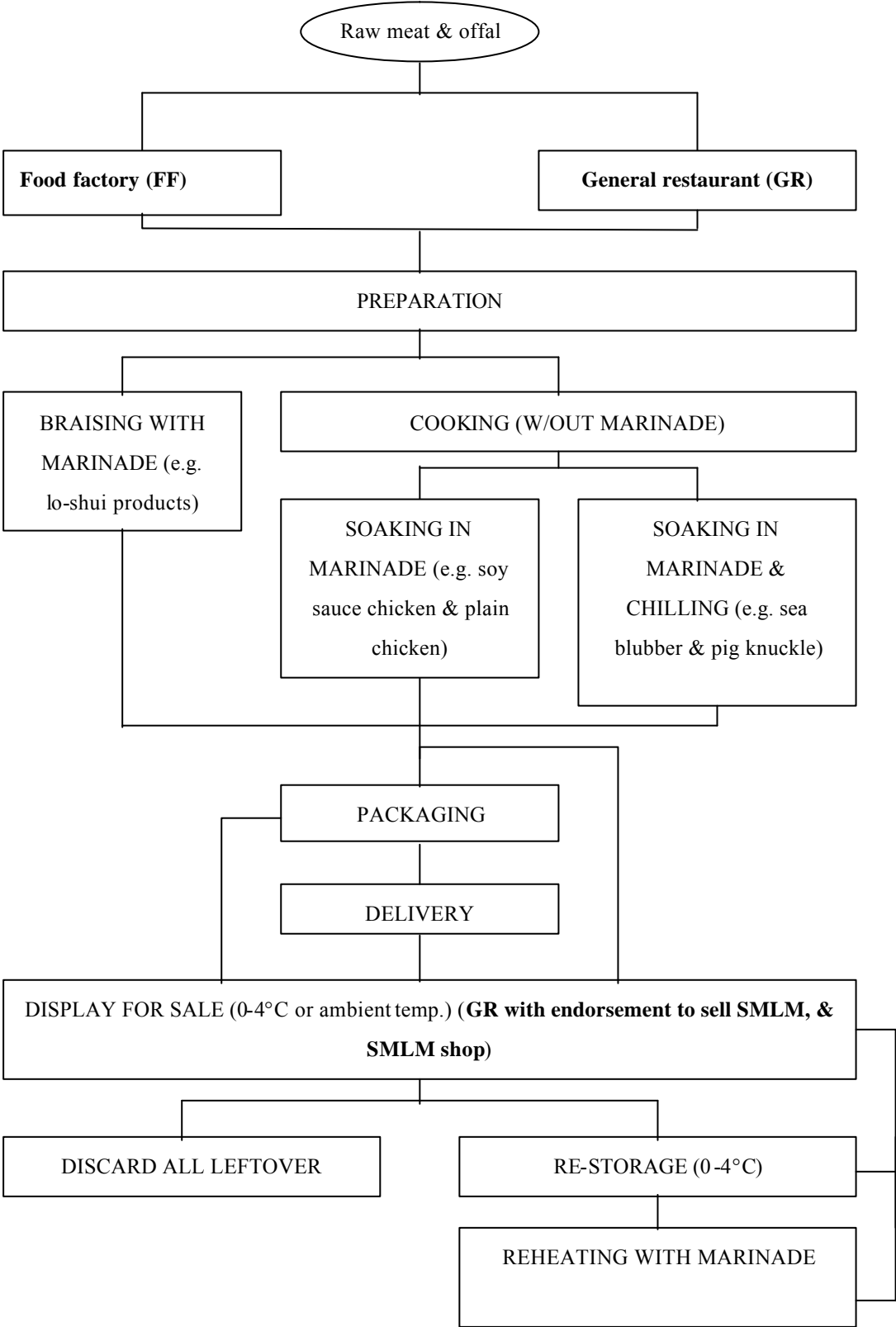


Table 1: Results of microbiological examination of siu-mei and lo-mei in 2000

	Total no. of sample	Unsatisfactory results		Remarks
		Hygieneic quality (Unsatisfactory rate)	Presence of Pathogens (Unsatisfactory rate)	
Siu-mei	406	4 (1.0%)	3 (0.7%)	<i>Salmonella</i> spp. (Roasted pork ; BBQ pork) <i>S. aureus</i> (Roasted pork)
Lo-mei	190	9 (4.7%)	2 (1.1%)	<i>S. aureus</i> (Steamed plain chicken x 2)
Total	596	13 (2.2%)	5 (0.8%)	—

FEHD Microbiological Guidelines for Ready-to-eat Food*

Unsatisfactory Hygienic quality (for Siu -mei and Lo -mei):

- TBC = 10^6 per gram
- *E. coli* (total) = 10^4 per gram

Unsatisfactory level of specific pathogens:

- *Salmonella* spp. present in 25g
- *Campylobacter* spp. present in 25g
- *E. coli* O157:H7 present in 25g
- *L. monocytogenes* present in 25 g
- *V. paraheamolyticus* = 1,000 per gram
- *S. aureus* = 10,000 per gram
- *C. perfringens* = 10,000 per gram
- *B. cereus* = 100,000 per gram

* The “Microbiological Guidelines for Ready-To-Eat Food” has been updated and the above guidelines may no longer be applicable. Please refer to the latest version at <http://www.fehd.gov.hk/english/safefood/control-ready-to-eat-food.html>