

**Risk Assessment Studies  
Report No. 68**

Microbiological Hazard Evaluation

**MICROBIOLOGICAL QUALITY OF  
SANDWICHES**

September 2022  
Centre for Food Safety  
Food and Environmental Hygiene Department  
The Government of the Hong Kong Special Administrative Region

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## Table of Contents

	<b><u>Page</u></b>
Executive Summary	2
Objectives	6
Introduction	6
Scope of Study	7
Methodology	8
Results	13
Discussion	15
Conclusion and Recommendations	18
References	19

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# **MICROBIOLOGICAL QUALITY OF SANDWICHES**

## EXECUTIVE SUMMARY

Sandwiches are considered potentially hazardous foods because pathogenic bacteria (e.g., *Salmonella* spp. and *Listeria monocytogenes*) may be present in some common ingredients such as eggs, salad dressing, sliced deli meats, fresh vegetables, etc. Besides, sandwiches may be contaminated with pathogens such as *Staphylococcus aureus* from human skin because sandwich preparation often involves the manual handling of ready-to-eat ingredients. During the past few years, local food poisoning outbreaks have been reportedly associated with the consumption of sandwiches, which have raised public concern about the safety of these products.

The Centre for Food Safety (CFS) conducted a study to evaluate the microbiological quality of sandwiches, especially those containing ingredients of high microbiological risks, available in retail outlets.

### Methodology

Between July and October 2021, 100 sandwich samples containing high-risk ingredients (i.e. eggs, cheeses, hams, fresh produce, etc.) were collected. The microbiological quality of sandwich samples was assessed against the criteria stipulated in CFS' Microbiological Guidelines for Food. The microbiological criteria include (a) aerobic colony count (ACC, a quality indicator), (b) *Escherichia coli* (a hygiene indicator), and (c) specific foodborne pathogens.

### Results and Discussion

In this study, the overall microbiological quality of sandwiches was found satisfactory. All samples were compliant with the microbiological food safety

criteria for pathogenic bacteria (i.e. *Salmonella* spp. and *L. monocytogenes* and *S. aureus*) as well as for the hygienic indicator organism, *E. coli*. Only one scrambled egg sandwich sample was found to have quality indicator ACC at an unsatisfactory level. This might be the result of improper practices such as improper storage of pooled eggs, inadequate cooking of eggs, and/or leaving sandwiches at room temperature for a prolonged period. A follow-up sample was taken and the result was satisfactory.

In this study, egg pooling is found to be a common practice in retail outlets and restaurants supplying scrambled egg sandwiches, and some businesses reported the pooled eggs were not for immediate use. Pooling of eggs has been documented as a food preparation practice that may contribute to outbreaks of *Salmonella* infection. In recent years, the CFS has been promulgating food safety measures to minimise the potential of contamination and proliferation of *Salmonella* in pooled eggs.

Processed cheese (e.g. packaged cheese), cooked cured meat (e.g. vacuum-packed ham), and fresh produce are usually used as ingredients in preparing sandwiches. These ingredients are also subject to contamination by food handlers during the preparation of sandwiches. Furthermore, leaving them under ambient conditions during preparation will allow the proliferation of bacteria. When handling ready-to-eat ingredients, food handlers should follow Good Hygiene Practices (GHPs) to prevent cross-contamination and the multiplication of bacteria. As a good practice, it is recommended to always store and display sandwiches, especially those with ingredients of high microbiological risk, in refrigerated cabinets and not at ambient temperature.

## **Conclusion**

In this study, the overall microbiological quality of sandwiches was satisfactory.

All samples were compliant with the microbiological food safety guideline levels for pathogenic bacteria as well as the guideline level for the hygiene indicator organism (i.e. *E. coli*) stipulated in the Microbiological Guidelines for Food.

Since sandwiches are potentially hazardous food, proper time and temperature control should be implemented to ensure food safety. Besides, good personal and environmental hygienic practices should be observed to minimise the chance of cross contaminations and the growth of bacteria. Food businesses also have the responsibility to provide sufficient ongoing food safety/hygiene training to their staff (i.e. food handlers in their businesses) as well as correct and appropriate information about their products to consumers for safe handling of sandwiches.

Below is some advice for the public and trade about the safe handling of sandwiches.

#### Advice to Trade

Good Hygiene Practices for preventing contamination in food should be followed at all times. Food businesses also have the responsibility to provide sufficient ongoing food safety/hygiene training to their staff (i.e. food handlers in their businesses). Further, a preventive food safety management system (such as the HACCP) should be established to ensure that effective control measures are in place to minimise potential contamination of the products during the manufacturing process. The CFS has issued “Sandwiches - Food Safety Guidelines for Food Businesses” that can be accessed via the following link:

[https://www.cfs.gov.hk/english/multimedia/multimedia\\_pub/files/sandwiches.pdf](https://www.cfs.gov.hk/english/multimedia/multimedia_pub/files/sandwiches.pdf)

#### Advice to Public

- Consume sandwiches as soon as possible after purchase.
- For pre-packaged sandwiches, follow the storage instructions on the packaging carefully and consume them before the use-by date.

- High-risk groups, including pregnant women, young children, the elderly, immunocompromised persons, and persons taking antibiotics and antacids, are advised not to consume sandwiches with raw or undercooked ingredients, including undercooked scrambled eggs.



## Microbiological Quality of Sandwiches

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### OBJECTIVES

The purpose of the study is to assess the microbiological quality of sandwiches containing high-risk ingredients available in the local market.

### INTRODUCTION

2. The Centre for Food Safety (CFS) conducted studies on the microbiological quality of sandwiches in 2000 and 2011. In the study conducted in 2011, no significant microbiological risk associated with sandwiches was identified.<sup>1</sup> However, during the last few years, local food poisoning outbreaks caused by sandwiches have raised public concern about the safety of sandwiches available in the local market.

3. In August 2015, a local food poisoning outbreak related to imported sandwiches contaminated with *Salmonella* was reported, involving more than 80 persons. The source of bacterial contamination was reportedly outside Hong Kong. It was believed that prolonged and improper storage of the sandwiches during distribution and delivery provided favourable conditions for the bacteria to grow and thus aggravated the level of contamination.<sup>2</sup> In 2020, another local outbreak related to sandwiches, involving more than 200 people, was reported.<sup>3</sup> Egg-containing sandwiches were found to contain *Salmonella*. Investigation revealed several factors that might contribute to the food poisoning outbreak. These factors included prolonged exposure to improper holding temperature during delivery, cross-contamination of cooked ingredients by raw ingredients during the preparation of sandwiches, inadequate personal hygiene, etc.

4. High-risk ingredients are commonly used in the production of sandwiches. Deli meats (such as pâté, ham, and salami), smoked fish, and diced chicken, which are eaten without further cooking or heating, are commonly used as ingredients in sandwiches. It has been reported that they can be contaminated with *Listeria monocytogenes*.<sup>4</sup> In the United Kingdom (UK) in 2019, nine listeriosis cases of which seven died, had consumed sandwiches in seven healthcare facilities.<sup>5, 6</sup> Investigation showed that an ingredient of the incriminated sandwiches was contaminated with *L. monocytogenes*.<sup>6</sup> A number of cases and outbreaks of salmonellosis have also been reported to be associated with the consumption of sandwiches containing undercooked eggs or egg products (such as mayonnaise made with raw eggs).<sup>7,8,9,10,11</sup> Fresh eggs, even those with clean and uncracked shells, may contain salmonella, and consumption of raw or undercooked eggs or egg products can cause foodborne illness.

5. As sandwich preparation often involves manual handling of ready-to-eat ingredients, pathogens like *Staphylococcus aureus*, present on human skin, may be transmitted from the hands to the sandwiches if good personal and environmental hygienic practices are not observed. Locally, around 5% of staphylococcal food poisoning outbreaks were reported to be associated with sandwiches and salads.<sup>12</sup> Poor hygiene of the food handlers was often identified as the contributing factor in causing the outbreaks.

6. In gist, sandwiches are potentially hazardous foods because pathogenic bacteria (e.g., *Salmonella* spp. and *L. monocytogenes*) may be present in some common ingredients such as eggs, salad dressing, sliced deli meats, raw vegetables, etc. Besides, as sandwich preparation often involves manual handling of ready-to-eat ingredients, pathogens such as *S. aureus* may be transmitted from human skin to the sandwiches.

## SCOPE OF STUDY

7. This study focused on sandwiches containing high-risk food ingredients (i.e. foods that require time and temperature control in order to prevent bacteria growth) such as eggs, fresh produce (e.g. sliced tomato), salad filling and dressing, ready-to-eat sliced meat, ready-to-eat seafood (e.g. smoked salmon), and cheese, etc.

## METHODOLOGY

### Sampling

8. Between July and October 2021, 100 sandwich samples containing high-risk ingredients were collected from different types of premises in different regions of Hong Kong (Table 1). Except for scrambled egg sandwiches, sandwiches receiving heat treatment right before serving (i.e. toasted sandwiches, or cooked whole sandwiches) were excluded.

**Table 1: Sampling distribution of sandwiches**

Region	No. of Samples Taken				Region Total
	Licensed bakery	Takeaway shop or stall	Convenient store	Restaurant	
Hong Kong Island	6	17	2	8	33
Kowloon	9	11	2	12	34
New Territories	7	14	1	11	33
<b>Total</b>	<b>22</b>	<b>42</b>	<b>5</b>	<b>31</b>	<b>100</b>

9. Among the 100 samples taken, 23 were sandwiches with scrambled eggs and 53 with fresh produce; the remaining 24 were sandwiches containing ham, cheeses, or smoked fish, and without fresh produce and scrambled eggs. (Table 2).

**Table 2. Sampling distribution of different types of samples**

Type	Total
Sandwiches with scrambled eggs	23
Sandwiches with fresh produce, such as lettuce, tomatoes, cucumber, etc.	53
Sandwiches without fresh produce and scrambled eggs (e.g. ham & cheese sandwiches and tuna sandwiches)	24
<b>Total</b>	<b>100</b>

10. Health inspectors of CFS were responsible for collecting samples. During the sampling of scrambled egg sandwiches, health inspectors were required to obtain information on egg-preparation practices from the shops. Samples were collected by observing the following criteria:

- (i) Samples should be collected from different districts within each region;
- (ii) Only one sample should be collected from a sampling site;
- (iii) No more than two samples should be collected from the same brand/retail chain; and
- (iv) If two samples were taken from the same brand/retail chain, they should be collected from two different stores.

#### Laboratory analysis

11. After collecting the samples, they were immediately stored at 0°C to 4°C and were delivered to the Public Health Laboratory Services Branch of the Centre for Health Protection, Department of Health, within four hours of sampling. Aerobic colony count (ACC), *Escherichia coli* count, presence or absence of *Salmonella* spp. in 25 g sample, *Staphylococcus aureus* and other coagulase-positive staphylococci count, and *Listeria monocytogenes* count were used to reflect the microbiological quality of sandwiches.

12. The enumeration of ACC in samples was performed using

bioMérieux TEMPO Aerobic Count (AC) kits. *E. coli* count in samples was performed using the AOAC Official Methods 991.14 (Revised: March 1998) (Petrifilm Method). *S. aureus* count was enumerated according to Method MFLP-21 Health Products and Food Branch, Ottawa (2004). The detection of *Salmonella* spp. was performed according to National Standard Method F13 issue 1 published by Health Protection Agency in the UK. Enumeration of *Listeria monocytogenes* was conducted according to ISO 11290-2:2017(E).<sup>13</sup>

### Result analysis

13. The microbiological results of the sandwich samples were analysed by the Risk Assessment Section of the CFS, and assessed against the criteria in CFS' Microbiological Guidelines for Food (the Guidelines).<sup>14</sup> The relevant criteria are extracted from the Guidelines and listed in Tables 3 and 4.

### *Quality and Hygiene – Aerobic Colony Count and E. coli*

14. Aerobic colony count is the total number of bacteria found in food. The level of ACC in food depends on the type and duration of processing that the food has received during production as well as how the food is handled and stored thereafter.<sup>15</sup> The number of bacteria increases significantly over time in response to poor temperature control of the product. Hence, ACC can highlight potential problems of storage and handling since production and provide clues for early detection of problems as well as about how the problems should be solved. It is worth noting that ACC is an indicator of quality but not safety.<sup>14</sup>

15. The Guidelines classifies ready-to-eat food products<sup>i</sup> into 14 categories

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<sup>i</sup>“Ready-to-eat food” means food intended by the producer or the manufacturer for direct human consumption without the need for cooking or other processing effective to eliminate or reduce to an acceptable level the

because several factors (such as the types of raw ingredients used and the nature of processing) may affect the ACC of a product at the point of sale (Annex I). For example, heat processes such as cooking will result in low ACC, and products containing raw ingredients such as fresh vegetables will have much higher ACC due to the natural flora present. Handling after heat processing such as slicing, portioning, packaging, etc. may increase the ACC, although this should be minimised by good hygienic practices.

16. Taking the types of ingredients used and the nature of processing into consideration, sandwich samples in this study were classified into categories 2, 5, and 12 according to the Guidelines (Table 3):

- Sandwiches containing raw vegetables (such as fresh lettuce or sliced fresh tomato) are likely to have high ACC because raw vegetables can contain high levels of bacteria as part of their normal microflora. Hence, high ACC do not reflect the quality of the sandwiches with raw vegetables. These sandwiches belong to category 12.
- Sandwiches containing ingredients such as sliced ham, cheeses, etc. are under category 5 because these ingredients will not be cooked prior to sale, and are likely to be handled (e.g. slicing, packaging, etc.) during preparation; hence, they should have higher ACC.
- Scrambled egg sandwiches belong to category 2 because the eggs are cooked prior to sale, and therefore ACC should be lower.

17. *E. coli* is a bacterium found in the gastrointestinal tract of humans and is commonly used as a faecal indicator to reflect the hygienic quality of a food product. *E. coli* are killed by the heat processes used in food production and should be readily removed from the equipment and surfaces by appropriate cleaning procedures. Its presence in food indicates direct or indirect faecal

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microorganisms of concern.

contamination, and a substantial number of *E. coli* in food suggests a general lack of cleanliness in handling and improper storage.<sup>14</sup>

**Table 3. ACC and *E. coli* criteria used in this study**

Food category in the Guidelines	Microbiological quality Result (colony-forming unit (cfu/g))		
	Satisfactory	Borderline	Unsatisfactory
<b>ACC [30°C /48 hours]</b>			
2. Foods cooked immediately prior to sale or consumption e.g. scrambled egg sandwiches	<10 <sup>3</sup>	10 <sup>3</sup> -<10 <sup>5</sup>	≥10 <sup>5</sup>
5. Cooked foods chilled but with some handling prior to sale or consumption e.g. ham & cheese sandwiches, sandwiches without salad	<10 <sup>5</sup>	10 <sup>5</sup> -<10 <sup>7</sup>	≥10 <sup>7</sup>
12. Fresh fruit and vegetables, products containing raw vegetables e.g. sandwiches with salad	N/A	N/A	N/A
<b>Hygiene indicator organisms</b>			
<i>E. coli</i>	<20	20 - ≤10 <sup>2</sup>	>10 <sup>2</sup>

Remark: For ACC, the detection limit is 100 cfu/g. For *E. coli*, the detection limit is 10 cfu/g.

### *Microbiological safety – Pathogens*

18. *Salmonella* spp., *L. monocytogenes*, and *S. aureus* are pathogenic bacteria. They have been involved in a number of local and overseas food poisoning outbreaks, and therefore were used to assess the safety of sandwiches in this study.

19. *Salmonella* can contaminate the inside of eggs before the shells are formed and also enter the eggs through pores or cracks on the shells.<sup>16</sup> *L. monocytogenes* is universally present in the environment. It can survive and multiply at temperatures as low as 0°C but can be easily destroyed under normal cooking temperatures. *L. monocytogenes* can grow to significant numbers at refrigeration temperatures when given sufficient time; hence, ready-to-eat foods with long shelf lives under refrigeration such as soft cheeses and ready-to-eat sliced meat may allow the bacterium to grow and cause food poisoning.<sup>14</sup> *S.*

*aureus* is one of the common food poisoning microorganisms in Hong Kong. The most common way of contamination of food is by contact with food handlers' hands, especially in the cases where the food is handled after cooking, and once contaminated with *S. aureus*, prolonged storage without refrigeration allows *S. aureus* to grow to high numbers and form enterotoxins. Although staphylococcal enterotoxins can also be produced in food by some other coagulase-positive staphylococci, e.g., *S. intermedius*, most coagulase-positive staphylococci which cause foodborne illness are *S. aureus*.<sup>14</sup>

20. The microbiological safety of the samples was determined using the criteria for pathogens of the Guidelines (Table 4).<sup>14</sup>

**Table 4. Pathogen criteria of the Guidelines**

Criterion	Result (cfu/g unless otherwise specified)		
	Satisfactory	Borderline	Unsatisfactory: potentially injurious to health and/or unfit for human consumption
<i>Salmonella</i> spp.	Not detected in 25g	N/A	Detected in 25g
<i>Listeria monocytogenes</i> ● For other ready-to-eat food	< 10	10 - ≤ 100	> 100
<i>S. aureus</i> and other coagulase-positive staphylococci	< 20	20 - ≤ 10 <sup>4</sup>	> 10 <sup>4</sup>

Remark: In general, the limits of "Satisfactory" are also the detection limits for respective pathogens.  
Remark: The detection limit of the test for *S. aureus* and other coagulase-positive staphylococci is 10 cfu/g.

## RESULTS

### Specific foodborne pathogens

21. No samples were detected with *Salmonella* spp., *L. monocytogenes*, and *S. aureus*, at levels that are considered potentially injurious to health (Table 4).



Quality and hygiene indicators – ACC and E. coli count

22. Among the 100 sandwich samples taken, 23 samples, 24 samples, and 53 samples were classified into categories 2, 5, and 12 respectively. For the 23 samples in category 2, only one sample ( $1.2 \times 10^5$  cfu/g) was of unsatisfactory quality, and three samples were rated as borderline quality (2,100 cfu/g, 4,500 cfu/g, and 8,600 cfu/g) (Table 5).

23. For the 24 samples in category 5, two ham and cheese sandwich samples were assessed as borderline quality ( $2.2 \times 10^6$  cfu/g and  $9.1 \times 10^5$  cfu/g).

24. For the 53 samples classified under category 12, they all contained raw ingredients (e.g. fresh vegetables such as lettuce, tomato, and cucumber, etc.) which inherently contained high ACC as natural flora. Hence, the ACC criterion does not apply to sandwiches of category 12.

**Table 5. ACC results of sandwiches (Number of applicable samples=47)**

	Microbiological results (cfu/g)					
	<10 <sup>3</sup>	10 <sup>3</sup> -<10 <sup>4</sup>	10 <sup>4</sup> -<10 <sup>5</sup>	10 <sup>5</sup> -<10 <sup>6</sup>	10 <sup>6</sup> -<10 <sup>7</sup>	≥10 <sup>7</sup>
<b>Microbiological quality (Food category 2)</b>	<b>Satisfactory</b>	<b>Borderline</b>		<b>Unsatisfactory</b>		
Foods cooked immediately prior to sale or consumption e.g. scrambled egg sandwiches (n=23)	19	3	0	1	0	0
<b>Microbiological quality (Food category 5)</b>	<b>Satisfactory</b>		<b>Borderline</b>		<b>Unsatisfactory</b>	
Cooked foods chilled but with some handling prior to sale or consumption	20	1	1	1	1	0

e.g. sandwiches without salad (n=24)						
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25. As regards the hygienic quality, all 100 samples were rated as satisfactory because their *E. coli* counts were less than 20 cfu/g (Table 3).

Egg pooling practice

26. Among the 18 shops that provided the information on egg-preparation practices, 13 claimed that the pooled eggs were for immediate use and five claimed not for immediate use (Table 6). Egg pooling refers to the practice of cracking and combining several eggs in a container, and using the combined eggs to make multiple servings of egg dishes or for use as an ingredient in sandwiches.

**Table 6. Egg-preparation practices of food premises supplying scrambled eggs sandwiches**

	Number of premises
Pooled eggs not intended for immediate use	5
Pooled eggs for immediate use	13
Total	18

**DISCUSSION**

27. In this study, the overall microbiological quality of sandwiches was satisfactory. All samples were compliant with the microbiological food safety guideline levels for pathogenic bacteria as well as the guideline level for the hygienic indicator (i.e. *E. coli*) stipulated in the Microbiological Guidelines for Food.

28. As regards the ACC, there were one scrambled egg sandwich with an unsatisfactory level as well as three scrambled egg sandwiches and two ham and

cheese sandwiches with borderline quality. The causes of the increased level of ACC were likely due to improper practices such as improper storage of pooled eggs and ready-to-eat ingredients (i.e. ham and cheese), inadequate cooking of eggs, and/or leaving the sandwiches at room temperature for a prolonged period. The vendors of the shops were reminded to follow the Good Hygienic Practices (GHPs) when handling ready-to-eat ingredients to prevent cross-contamination and the growth of bacteria. Follow-up samples were taken from the concerned shops and the levels of ACC were satisfactory.

29. In this study, egg pooling is found to be a common practice in local retail outlets and restaurants supplying scrambled egg sandwiches. It is a practice in some retail outlets and restaurants to save time and control portion size. There were also businesses that prepared pooled eggs not for immediate use, a practice if not carried out properly would lead to a food poisoning outbreak.

30. Pooling of eggs has been documented as a food preparation practice that may contribute to outbreaks of *Salmonella* infection. The reason behind this is that raw eggs may carry *Salmonella* and pooling allows one or more infected eggs to contaminate a whole pool of eggs which, if left at room temperature for a period of time, will allow multiplication of *Salmonella*. A study on *Salmonella* contamination of pooled raw shelled egg mix in the UK food service establishments found that *Salmonella* was present in one out of 764 pooled egg samples (0.13%), and many food handlers (41% of the premises) did not store pooled eggs at refrigeration temperature before use.<sup>17</sup> If the pooled eggs are not cooked thoroughly, this could cause an outbreak involving a large number of consumers.<sup>18</sup>

31. In recent years, the CFS has been promulgating food safety measures to minimise the potential of contamination and proliferation of *Salmonella* in pooled eggs.<sup>19,20,21</sup> In gist, pooled eggs for an order should be prepared for immediate

service as much as possible.<sup>22,23</sup> Pooled eggs not for immediate use should be kept in covered containers in the fridge and only the amount as needed is taken out. Further, all pooled eggs should be used on the day of pooling and should be cooked thoroughly.

### Temperature/time control

32. Sandwiches containing fresh produce, ready-to-eat ham, cheeses and/or eggs are potentially hazardous food, and should be refrigerated at 4°C or less, especially those that are prepared in advance for consumption at a later time. Time can be used as a means to ensure the safety of sandwiches because harmful bacteria take time to grow to high enough numbers to cause food poisoning. The Food Hygiene Code of Food and Environmental Hygiene Department (FEHD) states that a ready-to-eat potentially hazardous food may be displayed or stored at ambient temperature for a period of not more than four hours (i.e. 4-hour rule). If the business chooses to apply the 4-hour rule for display of freshly-prepared sandwiches, it should limit the amount of time the potentially hazardous ingredients (e.g. ham, fresh cut lettuce) are out of temperature control when preparing sandwiches. The total allowable time sandwiches can stay out of temperature control is four hours, so all durations during transport, storage or preparation of sandwiches between 4°C and 60°C must be taken into account.

33. Sandwiches can be prepared on the sales premises or prepared by another business and delivered to the premises for sale. If the business only has limited space for storage and display, it should only prepare or purchase an amount of sandwiches that can be adequately stored or displayed under temperature control (i.e.  $\leq 4^{\circ}\text{C}$ ). Signs can be used on the display cabinet to identify the time limit of display and reduce any risk of sandwiches being kept on display for long periods, especially those that are displayed at ambient temperature. Date marking and storage conditions, where appropriate, should be provided for the safe

handling of sandwiches by consumers.

### Limitations

34. In this study, only 100 samples were taken and because of a wide variety of sandwiches available in the market, only selected types were covered due to limited laboratory resources.

35. Collected samples were categorised based on ingredients and information given to the health inspectors. It should be noted that the food production process, the ingredients, and the storage condition, may vary among food producers.

### **CONCLUSION AND RECOMMENDATIONS**

36. In this study, the overall microbiological quality of sandwiches was satisfactory. All samples were compliant with the microbiological food safety guideline levels for pathogenic bacteria as well as the guideline level for the hygiene indicator organism (i.e. *E. coli*) stipulated in the Microbiological Guidelines for Food.

37. Since sandwiches are potentially hazardous food, proper time and temperature control should be implemented to ensure food safety. Besides, good personal and environmental hygienic practices should be observed to minimise the chance of cross contaminations and the growth of bacteria. Food businesses also have the responsibility to provide sufficient ongoing food safety/hygiene training to their staff (i.e. food handlers in their businesses) as well as correct and appropriate information about their products to consumers for the safe handling of sandwiches.

38. Below are some advice for trade and the public about the safe handling of sandwiches:

#### Advice to Trade

Good Hygiene Practices for preventing contamination in food should be followed at all times. Food businesses also have the responsibility to provide sufficient ongoing food safety/hygiene training to their staff (i.e. food handlers in their businesses). Further, a preventive food safety management system (such as the HACCP) should be established to ensure that effective control measures are in place to minimise potential contamination of the products during the manufacturing process. The CFS has issued “Sandwiches - Food Safety Guidelines for Food Businesses” that can be accessed via the following link:

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#### Advice to Public

- Consume sandwiches as soon as possible after purchase.
- For pre-packaged sandwiches, follow the storage instructions on the packaging carefully and consume them before the use-by date.
- High-risk groups, including pregnant women, young children, the elderly, immunocompromised persons, and persons taking antibiotics and antacids, are advised not to consume sandwiches with raw or undercooked ingredients, including undercooked scrambled eggs.

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## Annex I

### Guidance on the interpretation of results for ACC levels [30°C/48 hours] in various ready-to-eat foods

Food Category <sup>a</sup>	Examples	Result (colony-forming unit (cfu)/g)		
		Satisfactory	Borderline	Unsatisfactory
1. Ambient stable canned, bottled, cartoned and pouched foods immediately after removal from container <sup>b</sup>	Canned products such as tuna, salmon, corned beef, soups, stews, desserts and fruit; ultra-high-temperature (UHT) products	<10	N/A	Note <sup>c</sup>
2. Foods cooked immediately prior to sale or consumption	Takeaway food, burgers, kebabs, sausages, pizza, ready meals (cook/chill and cook/freeze) after regeneration, dim sum, rice, noodles	<10 <sup>3</sup>	10 <sup>3</sup> -<10 <sup>5</sup>	≥10 <sup>5</sup>
3. Cooked foods chilled but with minimum handling prior to sale or consumption; canned pasteurised foods requiring refrigeration	Whole pies, sausage rolls, samosas, flans, quiches, chicken portions; canned ham requiring refrigeration, pasteurised foods including fruit juice and soups; desserts	<10 <sup>4</sup>	10 <sup>4</sup> -<10 <sup>7</sup>	≥10 <sup>7</sup>
4. Bakery and confectionery products without dairy cream, powdered foods	Cakes without dairy cream, soup powders, milk powder, powdered dairy products, other reconstituted powdered foods ready to eat after reconstitution or warming	<10 <sup>4</sup>	10 <sup>4</sup> -<10 <sup>6</sup>	≥10 <sup>6</sup>
5. Cooked foods chilled but with some handling prior to sale or consumption	Sliced meats, cut pies, pâté, sandwiches without salad, hot smoked fish (mackerel, etc.), molluscs, crustaceans and other shellfish out of shell, non-prepackaged cold beverages with solid ingredients but without dairy components (iced green tea with red bean, etc.)	<10 <sup>5</sup>	10 <sup>5</sup> -<10 <sup>7</sup>	≥10 <sup>7</sup>
6. Non-fermented dairy products and dairy desserts, mayonnaise and mayonnaise based dressings, cooked sauces	Most butter, fresh cheese (mascarpone, paneer), trifle with dairy cream, satay, cakes with dairy cream, non-prepackaged cold beverages with solid ingredients and dairy components (iced milk tea with pearl tapioca, etc.)	<10 <sup>5</sup>	10 <sup>5</sup> -<10 <sup>7</sup>	≥10 <sup>7</sup>
7. Food mixed with dressings, dips, pastes	Coleslaw, dips, taramasalata, houmous	<10 <sup>6</sup>	10 <sup>6</sup> -<10 <sup>7</sup>	≥10 <sup>7</sup>
8. Extended shelf life food products requiring refrigeration	Modified atmosphere packaging (MAP) or vacuum packed products, e.g. meat, fish, fruit and vegetables	<10 <sup>6</sup>	10 <sup>6</sup> -<10 <sup>8</sup>	≥10 <sup>8 d</sup>
9. Raw ready-to-eat meat and fish, cold smoked fish	Sushi, sashimi, smoked salmon, gravalax	<10 <sup>6</sup>	10 <sup>6</sup> -<10 <sup>7</sup>	≥10 <sup>7</sup>
10. Preserved food products – pickled, marinated or salted	Pickled or salted fish, cooked shellfish in vinegar, vegetables in vinegar or oil, herbs, spices	N/A	N/A	N/A
11. Dried foods	Fruits, berries, vine fruits, nuts, sunflower seeds, herbs, spices, dried fish	N/A	N/A	N/A
12. Fresh fruit and vegetables, products containing raw vegetables	Whole fruit, pre-prepared fruit salads, vegetable crudités, salads, sandwiches with salad, mixed commodity salads containing raw vegetables, non-prepackaged cold beverages with solid and fresh fruit ingredients (chilled fresh mango juice with pomelo and sago, etc.)	N/A	N/A	N/A

Food Category <sup>a</sup>	Examples	Result (colony-forming unit (cfu)/g)		
		Satisfactory	Borderline	Unsatisfactory
13. Fermented, cured and dried meats, fermented vegetables, ripened cheeses	Continental sausages/salamis, jerky, sauerkraut, olives, bean curd, cheddar, stilton, brie, fermented milk drinks and butter, yoghurt, etc	N/A	N/A	N/A
14. Cooked meat products that may be displayed for sale at ambient temperature for a limited period of time e.g. siu-mei and lo-mei	Chinese poached chickens, roasted ducks and roasted pork	<10 <sup>5</sup>	10 <sup>5</sup> -<10 <sup>6</sup>	≥10 <sup>6</sup>

N/A denotes "Not applicable"

#### Notes:

- For food items that are not included in these food categories, their ACC level should be interpreted taking into account the raw ingredients used, and the nature and degree of processing before sale.
- Most products are normally sterile when sampled from the container but if they are consumed after subsequent further preparation then assess them as Category 5.
- These products are 'Unsatisfactory' if spore forming anaerobes are present but these require special tests for detection and enumeration. Spore forming aerobes are also usually absent in foods that have been cooked in their container but low levels may occur in canned fish products.
- Check for signs of spoilage. Lactic acid bacteria can grow well at refrigeration temperatures and do not grow well aerobically. Spoilage will eventually occur at a level of around 10<sup>9</sup> cfu/g due to the production of lactic acid. If the predominant organisms are Gram-negative bacteria, spoilage is likely to be noticeable at 10<sup>7</sup> to 10<sup>8</sup> cfu/g, e.g. taints, discolouration, and slime produced by pseudomonads, slime produced by other Gram-negative bacteria.