Microbiological Guidelines for Ready-to-eat Food

Objective:

This guideline is intended to facilitate surveillance of the microbiological content of various ready-to-eat foods and give recommendations on the appropriate control measures according to the assessment results.

Scope:

This guideline applies to ready-to-eat food for human consumption.

Definition:

Ready-to-eat food: It is the food provided by producer, manufacturer or retailer and intended for direct human consumption, and ready for immediate consumption at the point of sale. It can be raw or cooked, hot or chilled, and can be consumed without further heat treatment (including reheating).

Aerobic colony count: It is also known as the total viable count or standard plate count. It is the total number of bacteria growing in an aerobic environment in moderate temperature. Aerobic colony count is often used as an indicator to reflect the microbiological quality of food, and cannot directly contribute towards a safety assessment of ready-to-eat food.

Hygiene indicator organisms: They are bacteria indicators reflecting the food hygiene condition.

Pathogens: They refer to microbiological organisms that may cause food poisoning, including those that produce toxins in food or those that cause intestinal infection.

Content:

1. Components of microbiological criteria for ready-to-eat food

The evaluation of microbiological content in ready-to-eat food consists of the following three components:

- Aerobic colony count
- Hygiene indicator organisms
- Pathogens

2. Classification of microbiological quality

The microbiological quality can be divided into the following three classes:

- **Satisfactory:** The test results indicate good microbiological quality in food.
- **Borderline:** The test results are on the upper limit of acceptability, indicating the potential for food safety risk.
- **Unsatisfactory:** For aerobic colony count, the test results suggest that investigating the reasons for the high count may be considered. For hygiene indicator organisms, test results show remedial measures are required. Regarding pathogens, the test results at levels show that the product may be potentially injurious to health, and immediate remedial measures must be taken.

In response to the test results of aerobic colony count, hygiene indicator organisms and pathogens in ready-to-eat food, the authority is suggested to take appropriate operational measures for each class, i.e. satisfactory, borderline and unsatisfactory.

3. Interpretation of microbiological testing results

The microbiological parameters concerned in this guideline may not be necessarily considered for all food categories or for routine risk surveillance. The parameters for microbiological testing in ready-to-eat food should be appropriately selected based on the type of food samples and processing procedures, and interpretation of test results is also subject to a comprehensive assessment based on the food ingredients and production procedures.

The level of aerobic colony count in ready-to-eat food depends initially on the processing methods and duration of food production; thereafter the level depends on the food processing and storage. Therefore, the content of aerobic colony count will vary according to the different food categories and production processes. As a result, it is more reasonable to interpret the test results of aerobic colony count according to food category and food production process, which can be divided into the following five levels:

- **Level 1:** Canned food and ambient stable canned, bottled, cartoned and pouched food treated by ultra-high temperature.

- **Level 2:** Ready-to-eat food of which all food ingredients used are cooked by the time of final handling procedure (except for food referred to in Level 1 and Level 3).
- **Level 3:** Cooked meat products that may be displayed for sale at room temperature for a limited period of time; e.g. siu-mei and lo-mei.
- **Level 4:** Ready-to-eat food which contains some components that have been cooked prior to the processing procedure, ready-to-eat-food which has been cooked in advance and requires minimum handling (storage, slicing, preparation or mixing) prior to sale or consumption, or ready-to-eat food that does not need cooking.
- **Level 5:** Ready-to-eat food that is not applicable to aerobic colony count. Ready-to-eat foods such as fresh fruit, vegetables (including salad), pickled or dried food, fermented food, etc. High aerobic colony count value in these foods is caused by their normal micro-flora.

Table 1. Aerobic Colony Count

Aerobic Colony Count	Test Result (colony-forming unit (cfu)/g or cfu/ml)		
	Satisfactory [a]	Borderline [b]	Unsatisfactory [c]
Level 1	<10	N/A	Note[d]
Level 2	$<10^3$	10^3-$<10^5$	$\geq 10^5$
Level 3	$<10^5$	10^5-$<10^6$	$\geq 10^6$
Level 4	$<10^5$	10^5-$<10^7$	$\geq 10^7$
Level 5	N/A	N/A	N/A

N/A denotes “Not applicable”.

Note:

In response to the result, the authority is suggested to take appropriate operational measures (not exhaustive) for each class, i.e. satisfactory, borderline and unsatisfactory.

a. **Satisfactory:** No action is necessary.
b. **Borderline:** Comprehensive considerations regarding the nature of the food products (e.g. source of food, stage of shelf-life, etc) should be made before determining action. If other samples from the same source are also of borderline quality, further investigation may be appropriate.
c. **Unsatisfactory:** Consider investigating the reasons for the high count.
d. The products are "Unsatisfactory" if aerobic colony count test result ≥10 cfu/g or cfu/ml, or 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.

Table 2. Hygiene indicator organisms

Hygiene indicator organism	Test Result (cfu/g or cfu/ml)		
	Satisfactory [a]	Borderline [b]	Unsatisfactory [c]
Enterobacteriaceae [d]	$<10^2$	10^2-$\leq 10^4$	$> 10^4$
Escherichia coli [e]	<20	20-$\leq 10^2$	$> 10^2$

Note:
In response to the result, the authority is suggested to take appropriate operational measures (not exhaustive) for each class, i.e. satisfactory, borderline and unsatisfactory.

a. **Satisfactory:** No action is necessary.
b. **Borderline:** Advice food producers and traders to review all hygiene procedures (including cooking and cleaning), and consider taking food samples for investigative purposes. Take appropriate actions according to the detected levels of the organism.
c. **Unsatisfactory:** Advise food producers and traders to review all hygiene procedures (including cooking and cleaning), and take food samples for investigative purposes.
d. The criterion listed for Enterobacteriaceae applies to heat-treated foods, fishes, and cheeses. This criterion does not apply to fresh fruit and vegetables

or foods containing fresh fruit and vegetables as ingredients, because these food types can contain high levels of Enterobacteriaceae as part of their normal micro-flora.

e. The criterion listed for *Escherichia coli* does not apply to cheeses made from raw milk.

Table 3. Pathogens

Pathogens	Test Result (cfu/g or cfu/ml)		
	Satisfactory [a]	Borderline [b]	Unsatisfactory (potentially injurious to health and/or unfit for human consumption) [c]
Campylobacter spp. (thermotolerant)	n.d. in 25g/ml	N/A	Detected in 25g/ml
Escherichia coli O157 (and *other Shiga toxin-producing *Escherichia coli*)	n.d. in 25g/ml	N/A	Detected in 25g/ml
Salmonella spp.	n.d. in 25g/ml	N/A	Detected in 25g/ml
Vibrio cholerae (O1 and O139)	n.d. in 25g/ml	N/A	Detected in 25g/ml
Listeria monocytogenes [d] ● Ready-to-eat food which does not support growth of *Listeria monocytogenes*	<10	10-≤10^2	>10^2
● Ready-to-eat food which supports growth of *Listeria monocytogenes*	n.d. in 25g/ml	N/A	Detected in 25g/ml
● Ready-to-eat infant food	n.d. in 25g/ml	N/A	Detected in 25g/ml
Staphylococcus aureus and other coagulase-positive staphylococci	<20	20-≤10^4	>10^4
Clostridium perfringens	<10	10-≤10^4	>10^4
Bacillus cereus and other pathogenic *Bacillus*	<10^3	10^3-≤10^5	>10^5

n.d. = not detected; N/A = not applicable

* To be implemented when the testing capacity for this criterion is ready.

Note:

In response to the result, the authority is suggested to take appropriate operational measures (not exhaustive) for each class, i.e. satisfactory, borderline and unsatisfactory.

a. **Satisfactory:** No action is necessary.

b. **Borderline:** Risk will increase proportionally to the levels of pathogens detected. Advice food producers and traders to investigate and find out the causes and to adopt measures to improve the situation. Food samples should be taken again for investigative purposes.

c. **Unsatisfactory:** Immediate investigation should be taken to reveal the cause of the high count. Instruct food producers and traders to stop sale of food item concerned, investigate immediately and find out the causes and to adopt measures to improve the situation. Food samples should be taken again for investigative purposes. In addition, other enforcement actions, e.g. source tracing, should be considered.

d. The determination of the growth rate of *Listeria monocytogenes* under certain food and environment is based on scientific evidence, and reference can be made to the Codex Guidelines on the Application of General Principles of Food Hygiene to the Control of *Listeria monocytogenes* in Food (CAC/GL 61-2007). Under normal circumstances, refrigerated ready-to-eat food supports the growth of *Listeria monocytogenes*, and frozen ready-to-eat food does not support the growth of *Listeria monocytogenes*. If information is lacking to demonstrate that a ready-to-eat food item does not support the growth of *Listeria monocytogenes* during its expected shelf life, conservative approach should be taken, which means the food would be regarded as possible supportive of growth of *Listeria monocytogenes*.

4. Microbiological criteria for specific food items (For the microbiological parameters not listed in the following, the criteria as previously stated should be followed.)

Food samples that fail to meet the microbiological criteria for the food specified below are regarded as "unsatisfactory". Please refer to the suggestions on the previous article for corresponding actions and measures.

1) Microbiological criteria for edible ice

- Ice from ice manufacturing plants and packaged edible ice from retail outlets

Table 4. Microbiological criteria for ice from ice manufacturing plants and packaged ice from retail outlets

Parameters	Limits
Aerobic colony count	<500 cfu/ml
Escherichia coli	n.d. in 100ml
Coliform bacteria	n.d. in 100ml

cfu = colony-forming unit

n.d. = not detected

- Loose edible ice from retail outlets

Table 5. Microbiological criteria for loose ice from retail outlets

Parameters	Limits
Aerobic colony count	<1,000 cfu/ml
Escherichia coli	n.d. in 100ml
Coliform bacteria	<100 cfu/100ml

cfu = colony-forming unit

n.d. = not detected

2) Microbiological criteria for non-bottled drinks [a]

Table 6. Microbiological criteria for non-bottled drinks

Parameters	Limits
Escherichia coli	<100 cfu per ml/g
Salmonella spp.	n.d. in 25ml/g
Staphylococcus aureus and other coagulase-positive	<100 cfu per ml/g

staphylococci	
Clostridium perfringens	<100 cfu per ml/g

cfu = colony-forming unit

n.d. = not detected

Note:

a. In general, non-bottled drinks are those drinks prepared for immediate consumption and do not require storage in sealed bottles, cans or other containers by production lines, for example, fresh fruit juice, diluted drinks prepared from concentrated fruit juice or syrup, soya bean milk, etc.

3) Microbiological criteria in ready-to-eat food with aquatic products of animal origin

Table 7. Microbiological criteria in ready-to-eat food with aquatic products of animal origin

Parameters	Limit
Vibrio parahaemolyticus	<1000 MPN per ml/g

Updated in June 2025