LHAAC

LOCAL HEALTH AUTHORITIES ANALYTICAL COMMITTEE

# COORDINATED SAMPLING PROJECT 27 -

# Locally Produced Ready-to-Eat Meals

**Conducted October 2019 with Local Government's across Western Australia**


**Local Health Authorities Analytical Committee**

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## Acknowledgements

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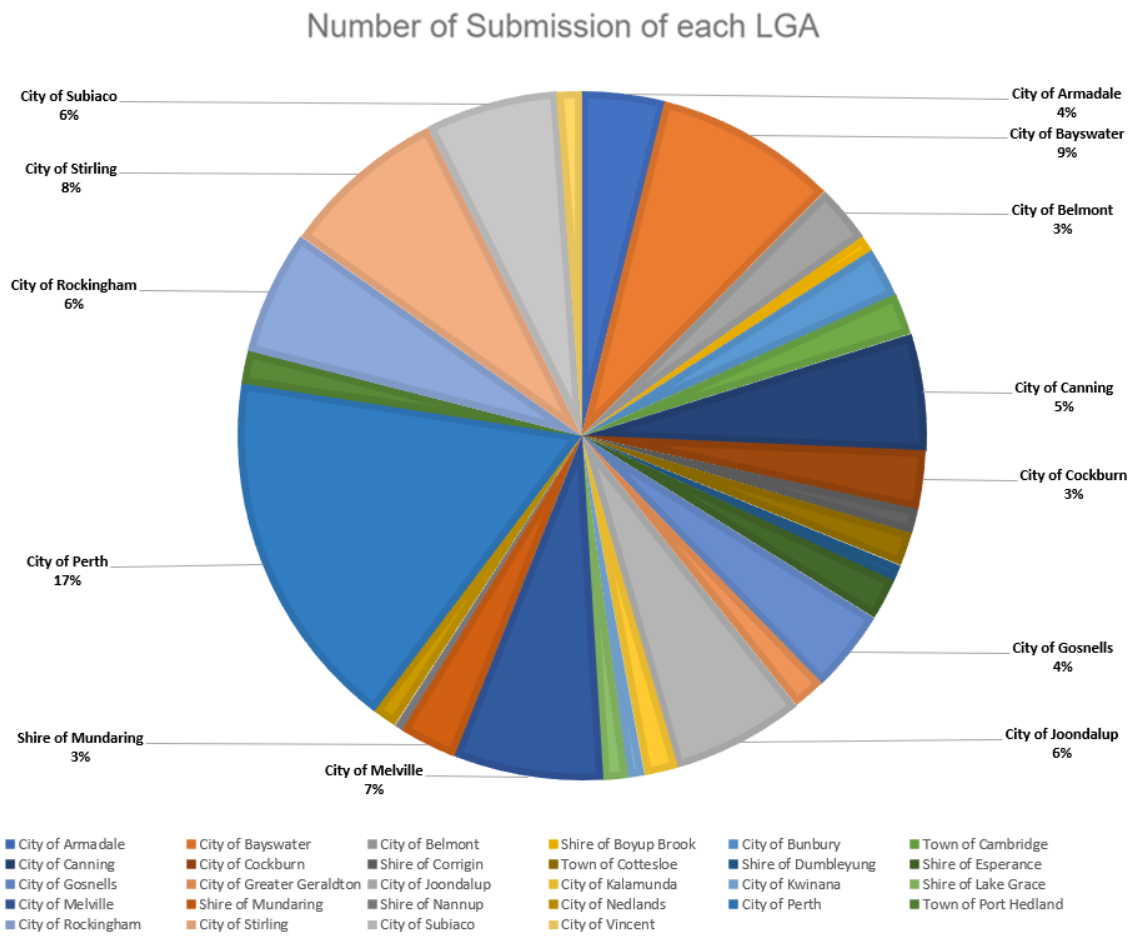


## Executive Summary

This study aimed to assess the microbiological quality, and safety, of locally produced meals. Typically, these will be meals packaged by WA manufacturers (and restaurants possibly) for sale at WA based supermarkets (e.g. IGA, Farmer Jacks, Spud Shed) as well as exercise gyms and smaller boutique grocery outlets.

Western Australian (WA) Environmental Health Officers (EHO) submitted samples for assessment to Agrifood Technology (AT) or Eurofins Analytical Reference Laboratory (EARL) in October 2019. At the end of the sampling period, 28 Local Government Authorities (LGA) had submitted a total of 257 food samples to the laboratory for analysis. All food samples were tested for Standard Plate Count and the presence of Escherichia coli (E. coli), Coagulase-positive Staphylococci, Bacillus Cereus (B. Cereus), Salmonella species (spp.), and Listeria Monocytogenes (L. Monocytogenes), Vibrio parahaemolyticus (V. parahaemolyticus), and Campylobacter spp.

Test results were assessed by the LGA against Food Standards Australia and New Zealand's (FSANZ) Compendium of Microbiological Criteria for Food. The results were categorised as satisfactory, marginal, unsatisfactory or potentially hazardous. Where necessary, further investigation or action by the appropriate LGA was undertaken.

Level 2 Standard Plate Count test results indicated 81.3% of samples to be within the satisfactory range, while marginal levels were reported in 9.7% of samples, and unsatisfactory levels were recorded in 8.9% of samples. E. coli test results indicated 99.2% of samples to be within the satisfactory range, while marginal levels were reported in 0.8% of samples. Coagulase-positive Staphylococci test results indicated 99.2% of samples to be within the satisfactory range, while marginal levels were reported in 0.4% of samples and unsatisfactory level were reported in 0.4% of samples. B. Cereus test results indicated 93% of samples to be within the satisfactory range, while marginal levels were reported in 4.3% of samples, and unsatisfactory levels were recorded in 2.7% of samples. L. monocytogenes test results indicated 99.2% of samples to be within the satisfactory range, and potentially hazardous levels were recorded in 0.8% of samples. Salmonella spp., as well as Campylobacter spp. and Vibrio Parahaemolyticus, test results indicated 100% of samples to be within the satisfactory range.

# Contents

## Abbreviations

| | |
|---|---|
| **AT** | **Agrifood Technology** |
| **CSP** | **Coordinated Sampling Project** |
| **EARL** | **Eurofins Analytical Reference Laboratory** |
| **EHO** | **Environmental Health Officer** |
| **FSANZ** | **Food Standards Australia and New Zealand** |
| **FSC** | **Food Standards Code** |
| **LGA** | **Local Government Authority** |
| **LHAAC** | **Local Health Authorities Analytical Committee** |
| **NATA** | **National Association of Testing Authorities** |
| **RTE** | **Ready-to-eat** |
| **SPC** | **Standard plate count** |
| **Spp.** | **Species** |
| **WA** | **Western Australia** |

# 1.0 Introduction

## 1.1 Background

As a microbiologically based Coordinated Sampling Project (CSP) conducted by the Local Health Authorities Analytical Committee (LHAAC), this project involved the microbial analysis of locally prepared Ready-to-Eat (RTE) meals.

Ready-to-Eat (RTE) food is food that is ordinarily consumed in the same condition in which it is sold or distributed and does not include nuts in the shell and whole, raw fruits and vegetables that are intended for hulling, peeling or washing by the consumers. The meals may be re-heated by consumers, but the food is already cooked.

## 1.2 Standards

Microbiological guidelines can be used by regulatory agencies to check that food for sale is safe and suitable and the food handling controls, and hygienic practices of food business are adequate. The microbial quality of food products analysed for this project was assessed using FSANZ's Compendium of Microbiological Criteria for Food [1].

| | Microbiological Quality (CFU per gram) | | | |
|---|---|---|---|---|
| | **Satisfactory** | **Marginal** | **Unsatisfactory** | **Potentially Hazardous** |
| **Standard Plate Count** | | | | |
| Level 2 | $<10^6$ | $<10^7$ | $\geq 10^7$ | |
| **Indicators** | | | | |
| *Escherichia coli* | <3 | 3 – 100 | ≥100 | [a] |
| **Pathogens** | | | | |
| Coagulase +ve staphylococci | $<10^2$ | $10^2 - 10^3$ | $10^3 - 10^4$ | $\geq 10^4$ SET +ve |
| *Clostridium Perfringens* | $<10^2$ | $10^2 - 10^3$ | $10^3 - 10^4$ | $\geq 10^4$ |
| *Bacillus Cereus* | $<10^2$ | $<10^2 – 10^3$ | $10^3 - 10^4$ | $\geq 10^4$ |
| *Vibrio Parahaemolyticus* [b] | <3 | $<3 - 10^2$ | $<10^2 - 10^4$ | $\geq 10^4$ |
| Campylobacter spp | Not Detected in 25g | | | Detected |
| Salmonella spp | Not Detected in 25g | | | |
| *Listeria monocytogenes* (RTE where growth will not occur) [d] | Not Detected in 25g | Detected but $<10^2$ [c] | | $>10^2$ [d] |
| Listeria monocytogenes (RTE where growth can occur) [c] | Not Detected in 25g | Detected | Detected | Detected |

### 1.3 Bacterial Contamination Risk and Foodborne Illness

The production of RTE food products requires extensive handling prior to sale. The microbiological quality of food can be impacted by temperature control, food handler hygiene and food quality [2]. There is a risk of bacteria transferring to food ingredients at any stage including transport, processing, storage, and at the point of sale. Food that is contaminated with pathogenic microorganisms can cause the consumer to suffer from foodborne illnesses. Bacteria that are commonly responsible for causing foodborne illnesses include E. coli, Salmonella spp., L. monocytogenes, and Campylobacter spp. [3]. In fact, the three microorganisms most commonly associated with microbial food recalls in Australia between 2008 and 2017 were E. coli, Salmonella spp., and L. monocytogenes [4].

### 1.4 Temperature Control

RTE food is not expected to undergo further cooking or processing prior to consumption. These types of meals would generally be considered as potentially hazardous foods as they usually need to be kept under temperature control to minimise the growth of pathogenic microorganisms that may be present in the food, or to prevent the formation of toxins in the food.

The production and sale of food in WA must comply with the requirements of the Australia New Zealand Food Standards Code (FSC). As per Standard 3.2.2 of the FSC, potentially hazardous food must be stored under temperature control which can be achieved by either refrigeration to below 5° Celsius or heating to above 60° Celsius [5]. In accordance with the FSC, a food business may maintain the food out of temperature control if it can be demonstrated that the alternative temperature does not adversely affect the microbiological safety of the food [5]. Food businesses often achieve this requirement with the application of the 2 hour – 4-hour rule (Appendix B), a process that requires documented procedures to ensure that potentially hazardous food is safe while stored out of temperature control for a limited time [6] [7].

## 2.0 Methodology

Sampling instructions were supplied to WA LGAs. Both metropolitan and non-metropolitan LGAs were encouraged to participate in this CSP if suitable products were available in their locality. The number of samples to be collected was determined by each LGA in consideration of their sampling allowance and other activity planned or anticipated for the financial year.

Samples of RTE meals from across WA were submitted to either AT or Eurofins ARL, the two appointed analysts to the LHAAC in October 2019. The minimum sample size for submission to the analysts was 200 grams. Each laboratory conducted microbial analysis of the samples utilising National Association of Testing Authorities (NATA) accredited methods (Appendix A). All of the food samples (257) were tested for the presence of E. coli, Coagulase-positive Staphylococci, B. cereus, Salmonella spp., and L. monocytogenes, Campylobacter spp. 6 samples were tested for V. parahaemolyticus.

Upon completion, LGAs were requested to review the results by assessing them against the FSANZ's microbiological guidelines (Appendix C) [1]. Recommended follow-up actions were provided to each LGA within the sampling instructions.

## 3.0 Result

By the end of the sampling period, 28 LGAs had submitted a total of 257 food samples of varying types to the laboratories for analysis. Overall, a total of 1,727 tests were carried out. All 257 samples were tested for the presence of E. coli, Coagulase-positive Staphylococci, B. Cereus, Salmonella spp., L. Monocytogenes, and Campylobacter spp., and 6 samples were tested for V. Parahaemolyticus. All test results were compared against the FSANZ's microbiological guidelines (Table 1)

**Table 1. Guideline levels for determining the microbiological quality of RTE foods [1].**

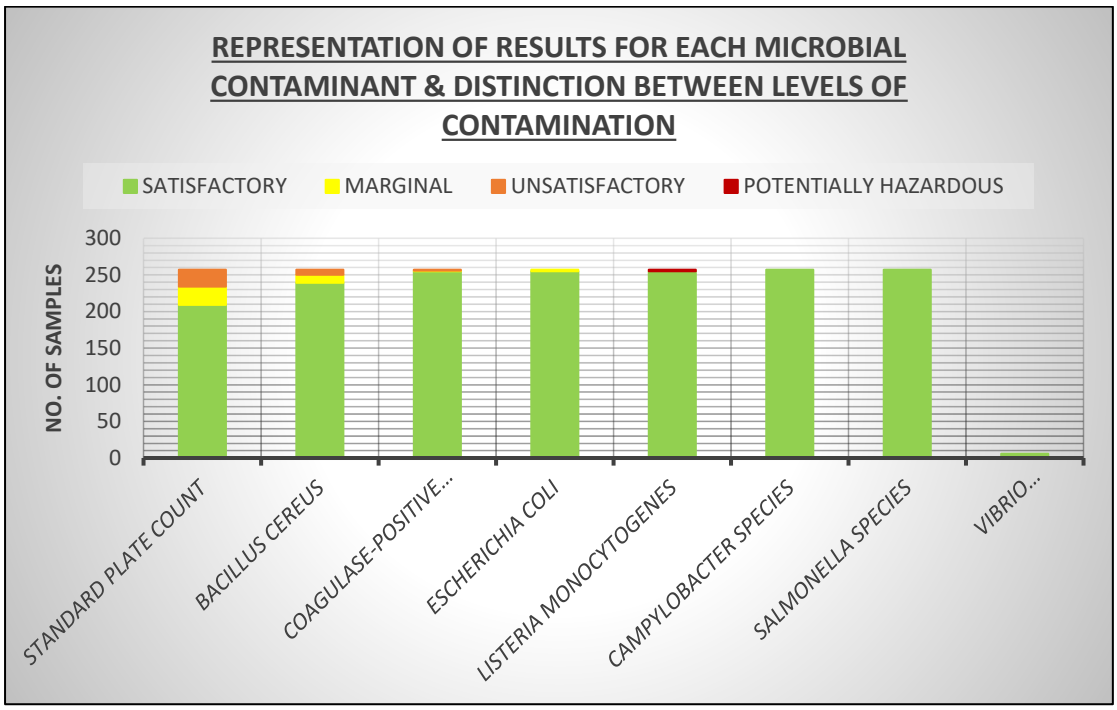
| | Microbiological Quality (CFU per gram) | | | |
|---|---|---|---|---|
| | Satisfactory | Marginal | Unsatisfactory | Potentially Hazardous |
| **Standard Plate Count** | | | | |
| Level 2 | $<10^6$ | $<10^7$ | $\geq 10^7$ | |
| **Indicators** | | | | |
| *Escherichia coli* | <3 | 3 – 100 | ≥100 | [a] |
| **Pathogens** | | | | |
| Coagulase +ve staphylococci | $<10^2$ | $10^2 - 10^3$ | $10^3 - 10^4$ | $\geq 10^4$ SET +ve |
| *Clostridium Perfringens* | $<10^2$ | $10^2 - 10^3$ | $10^3 - 10^4$ | $\geq 10^4$ |
| *Bacillus Cereus* | $<10^2$ | $<10^2 – 10^3$ | $10^3 - 10^4$ | $\geq 10^4$ |
| *Vibrio Parahaemolyticus* [b] | <3 | $<3 - 10^2$ | $<10^2 - 10^4$ | $\geq 10^4$ |
| Campylobacter spp | Not Detected in 25g | | | Detected |
| Salmonella spp | Not Detected in 25g | | | |
| *Listeria monocytogenes* (RTE where growth will not occur) [d] | Not Detected in 25g | Detected but $<10^2$ [c] | | $>10^2$ [d] |
| Listeria monocytogenes (RTE where growth can occur) [c] | Not Detected in 25g | Detected | Detected | Detected |

Upon analysis, Level 2 Standard Plate Count test results indicated 81.3% (n=209) of samples to be within the satisfactory range, while marginal levels were reported in 9.7% (n=25) of samples, and unsatisfactory levels were recorded in 8.9% (n=23) of samples. E. coli test results indicated 99.2% (n = 255) of samples to be within the satisfactory range, while marginal levels were reported in 0.8% (n = 2) of samples. Coagulase-positive Staphylococci test results indicated 99.2% (n = 255) of samples to be within the satisfactory range, while marginal level was reported in 0.4% (n = 1) and unsatisfactory level was reported in 0.4% (n=1) of samples. B. Cereus test results indicated 93% (n = 239) of samples to be within the satisfactory range, while marginal levels were reported in 4.3% (n = 11) of samples, and unsatisfactory levels were recorded in 2.7 % (n = 7) of samples.

L. monocytogenes, test results indicated 99.2% (n = 255) of samples to be within the satisfactory range and while potentially hazardous levels were reported in 0.8% (n = 2) of samples. Salmonella spp., as well as

Campylobacter Sp. test results indicated 100% (n = 257) of samples to be within the satisfactory range. V. Parahaemolyticus test results indicated 100% (n = 6) of samples to be within the satisfactory range.

**Figure 2. Represents the test results for each microbial contaminant and provides a visual distinction between levels.**




When compared against the FSANZ guideline levels for determining the microbiological quality of RTE foods, 96.0 % of all test results indicated that the sample was within the satisfactory range, 2.2 % indicated marginal levels of microbial contamination, 1.7 % indicated unsatisfactory levels of microbial contamination, and no case of potentially hazardous levels of microbial contamination (Table 2.).

**Table 2. Test results by level of microbial contamination**

| Indicator/Pathogen | Satisfactory | Marginal | Unsatisfactory | Potentially Hazardous | TOTAL |
|---|---|---|---|---|---|
| *Standard Plate Count* | 209 | 25 | 23 | N/A | 257 |
| *Bacillus cereus* | 239 | 11 | 7 | 0 | 257 |
| *Coagulase-Positive Staphylococci* | 255 | 1 | 1 | 0 | 257 |
| *Escherichia coli* | 255 | 2 | 0 | 0 | 257 |
| *Listeria monocytogenes* | 255 | 0 | N/A | 2 | 257 |
| *Campylobacter Species* | 257 | N/A | N/A | 0 | 257 |
| *Salmonella Species* | 257 | N/A | N/A | 0 | 257 |
| *Vibrio parahaemolyticus* | 6 | 0 | 0 | 0 | 6 |
| TOTAL | 1727 | 39 | 31 | 2 | 1799 |
| Percentage | 96.00% | 2.20% | 1.70% | 0.10% | 100% |

# 4.0 Discussion

## 4.1 Standard plate count

Standard plate count can provide a general indication of the microbiological quality of a food. A standard plate count will not differentiate between the natural microflora of a food, spoilage microorganisms, organisms added to fermented foods or pathogenic microorganism. It cannot be used to predict the safety of the product and will be influenced by the storage conditions of the product. Depending on the product, a high standard plate count may indicate that the product may have been prepared unhygienically or stored inappropriately [8].

257 samples were assessed as being in the level 2 category of SPC. The results for these products ranged from <10 to 1.1 x $10^8$ cfu/g. 25 samples (9.7%) were in the marginal range and a total of 23 samples (8.9%) were in the unsatisfactory range.

The FSANZ guidelines have 5 different levels for SPC results, ranging from fully cooked foods such as pizza or fish & chips which would be expected to have a lower SPC compared to a meal containing uncooked salad ingredients where there is no SPC limit (due to inherently high plate count because of the normal microbial flora). Due to the co-ordination of the survey by LHAAC level 2 was chosen for the SPC results, although some individual samples may have been more appropriately assigned a different level. This should be considered by LGA's when assessing results and the correct SPC category chosen, based on the specific food sample submitted.

## 4.2 Escherichia coli

E. coli is a bacterium that is naturally found in human and animal intestines [9]. It is often spread to food via the faecal-oral route and can cause an infection when ingested [9]. As such, their presence in ready-to-eat foods (fully cooked or those containing raw fruits or vegetables) can be an indication of poor hygiene and sanitation or inadequate heat treatment [8]. Since the presence of E. coli suggests faecal contamination, microbiological tests are often conducted to provide a reference in order to evaluate the hygienic quality of food [10].

The results from this CSP indicated that 255 of 257 samples (99.2%) which were tested for the presence of E. coli fell within satisfactory levels when compared against the microbiological guidelines from FSANZ [1]. 2 samples (0.8%) indicated marginal levels. These results indicate that the samples tested had been handled hygienically. The detection of E. coli in foods is not a direct indication that the food is unsafe rather it is an indication of potential problems involving the preparing and handling of foods

### 4.3 Coagulase-positive Staphylococci

Staphylococcus is a genus of bacteria which can be further categorised by its ability to produce coagulase [11]. Coagulase-positive species are generally considered potentially pathogenic to humans [11]. Staphylococcus aureus (S. aureus) is a Coagulase-positive species that can cause food poisoning [12]. Some humans naturally carry S. aureus on their skin and in their nose. S. aureus can transmit to food as a result of poor food handling practices and temperature abuse can result in its multiplication [12].

The results from this CSP indicated that 255 of 257 samples (99.2%) which were tested for the presence of coagulase-positive Staphylococcus fell within satisfactory levels when compared against the microbiological guidelines from FSANZ [1]. 1 sample (0.4%) indicated marginal level and 1 sample (0.4%) unsatisfactory level.

### 4.4 Bacillus cereus

B. cereus is a bacterium that is found in nature and is commonly detected in soil. It is usually found in raw ingredients and is commonly associated with rice dishes [1]. B. cereus illness is often related to improper cooling of food and temperature abuse [13]. There are two main types of foodborne illness that are caused by the bacterium, one is characterised by vomiting or nausea while the other causes diarrhoea [13].

The results from this CSP indicated that 239 of 257 samples (93%) which were tested for the presence of B. Cereus fell within satisfactory levels when compared against the microbiological guidelines from FSANZ [1]. 11samples indicated marginal levels (4.3%) and 7 samples (2.7%) reported in unsatisfactory level. This result suggests that handling controls are not being implemented appropriately at the food premises where the affected samples were produced [1].

### 4.5 Campylobacter spp.

Campylobacter is a species of bacteria that is found within the gastrointestinal system and faecal matter of animals and is most commonly in or on raw poultry [16]. A condition known as Campylobacteriosis is caused by ingesting undercooked or Campylobacter spp. contaminated meat, particularly chicken, which infects the digestive tract of humans [16]. Campylobacteriosis is considered to be the most common bacterial cause of human gastroenteritis worldwide, accounting for around half of all reported gastrointestinal infections in WA [16] [17].

The results from this CSP indicated that Campylobacter spp. was not detected in any of the 257 samples. This result suggests that the food outlets who supplied these samples have taken care in both the preparation and in the cooking process of the RTE meals which contained poultry.

### 4.6 Salmonella spp.

Salmonella spp. are bacteria which are known to cause a disease called Salmonellosis which is characterised by abdominal pain, diarrhoea and occasionally vomiting [18]. Salmonella spp. can transmit from animals to contaminate food of animal origin (such as eggs, meat or dairy) or it can be transmitted by humans through the faecal-oral route [18].

The results from this CSP indicated that Salmonella spp. was not detected in any of the 257 samples. This result suggests that the food outlets who supplied these samples have taken care in both the preparation and in the cooking process of the RTE meals.

### 4.7 Listeria monocytogenes

L. monocytogenes is a bacterium responsible for causing a foodborne disease named Listeriosis [19]. Non-invasive Listeriosis can affect otherwise healthy individuals with symptoms including headache, muscle pain, fever and diarrhoea [19]. Invasive Listeriosis is a serious threat to high-risk population groups including pregnant women, the immunocompromised, children and the elderly [20]. Symptoms of invasive Listeriosis can include septicaemia and bacterial meningitis, with symptoms capable of causing premature death [19].

The results from this CSP indicated that 255 samples (99.2%) which were tested for the presence of L. monocytogenes fell within satisfactory levels when compared against the microbiological guidelines from FSANZ. 2 samples reported potentially hazardous results (0.8%) which detected <10 CFU/g in Listeria monocytogenes Enumeration. This result suggests that most of the food outlets who supplied these samples have taken care in both the preparation and in the cooking process of the RTE foods. Continued education on safe food handling procedures will assist in preventing the spread of L. monocytogenes in food businesses [19].

### 4.8 Vibrio Parahaemolyticus

V. parahaemolyticus is a bacterium found naturally in salt water [14]. It can cause gastroenteritis when consumed and is most often associated with raw or undercooked shellfish, fish or crustaceans [1]. Accordingly, this CSP only tested for the presence of V. parahaemolyticus in products containing raw seafood.

The results from this CSP indicated that 6 of 6 samples which were tested for the presence of V. parahaemolyticus fell within satisfactory levels when compared against the microbiological guidelines from FSANZ. This result suggests that the food outlets who supplied these samples have taken care in the preparation of the RTE meals which contained raw seafood.

## 5.0 Conclusion

This CSP looked at the microbiological quality of locally produced RTE meals. All the samples (n=275) were tested for the SPC and the presence of E. coli, Coagulase-positive Staphylococci, B. cereus, Salmonella spp., L. monocytogenes, Campylobacter spp. and 6 samples were tested for V. Parahaemolyticus.

Salmonella spp., Campylobacter spp. and V. Parahaemolyticus was not detected in any of the 257 samples. 99.2% of food samples which were tested for the presence of Coagulase-positive Staphylococci, E. coli and L. monocytogenes both fell within satisfactory levels. Most of results are within expected microbiological levels and present no food safety concern.

However, 2 food samples reported potentially hazardous results (0.8%) which detected <10 CFU/g in Listeria monocytogenes Enumeration which were outside of the expected microbiological levels for this type of product and presented a potential food safety concern. Healthy people rarely become ill from listeria infection, but the disease can be fatal to unborn babies, newborns, and people with weakened immune systems.

Overall, the results demonstrated that the vast majority (96%) of test results were within satisfactory levels of microbiological quality when assessed against FSANZ's microbiological guidelines for RTE food. This reflects well on the WA food industry, who demonstrated they provide a good quality of RTE meals. This high level of service is complimented by rigorous food safety measures practiced by both Local Government environmental health staff and Department of Health officers.

## 6.0 References

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## Appendix A

Raw Data

For further questions or inquiries about raw data, contact LHAAC Co-ordinator Trevor Chapman:

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## Appendix B

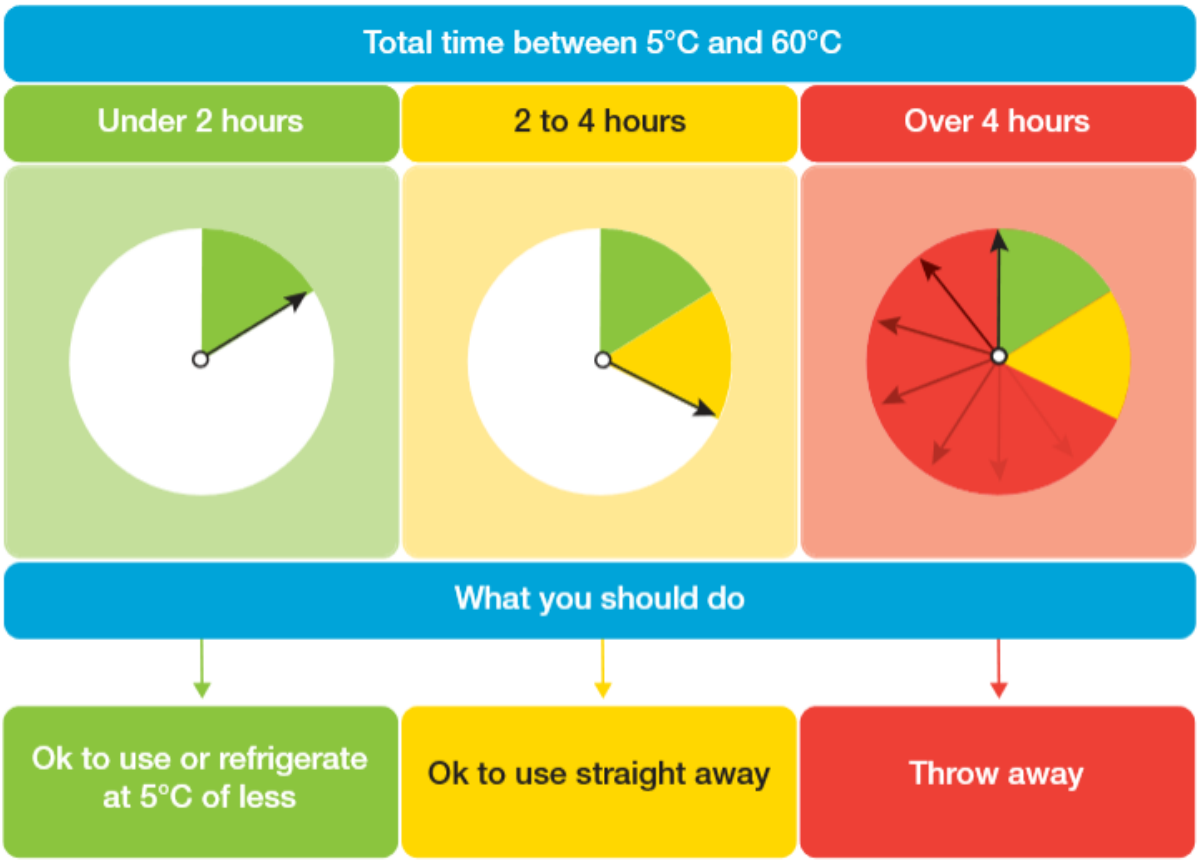


Figure 3. A visual representation of the 2 hour – 4-hour rule [7]

# Appendix C

Table 3. Guidelines for the determination of microbiological quality in RTE food products [1].

| | Microbiological Quality (CFU per gram) | | | |
|---|---|---|---|---|
| | **Satisfactory** | **Marginal** | **Unsatisfactory** | **Potentially Hazardous** |
| **Standard Plate Count** | | | | |
| Level 2 | $<10^6$ | $<10^7$ | $\geq 10^7$ | |
| **Indicators** | | | | |
| *Escherichia coli* | <3 | 3 – 100 | ≥100 | [a] |
| **Pathogens** | | | | |
| Coagulase +ve staphylococci | $<10^2$ | $10^2 - 10^3$ | $10^3 - 10^4$ | $\geq 10^4$ SET +ve |
| *Clostridium Perfringens* | $<10^2$ | $10^2 - 10^3$ | $10^3 - 10^4$ | $\geq 10^4$ |
| *Bacillus Cereus* | $<10^2$ | $<10^2 - 10^3$ | $10^3 - 10^4$ | $\geq 10^4$ |
| *Vibrio Parahaemolyticus* [b] | <3 | $<3 - 10^2$ | $<10^2 - 10^4$ | $\geq 10^4$ |
| Campylobacter spp | Not Detected in 25g | | | Detected |
| Salmonella spp | Not Detected in 25g | | | |
| *Listeria monocytogenes* (RTE where growth will not occur) [d] | Not Detected in 25g | Detected but $<10^2$ [c] | | $>10^2$ [d] |
| Listeria monocytogenes (RTE where growth can occur) [c] | Not Detected in 25g | Detected | Detected | Detected |

(a) = Pathogenic strains of E. coli should be absent.

(b) = V. parahaemolyticus should not be present in seafood that has been cooked. For RTE seafood that is raw, a higher satisfactory level may be applied (<102 CFU/g). The potentially hazardous level of V. parahaemolyticus relates to Kanagawa-positive strains.

(c) = The detection of L. monocytogenes in RTE foods prepared specifically for 'at risk' population groups (the elderly, immunocompromised and infants) should also be considered as potentially hazardous.

(d) = Foods with a long shelf life stored under refrigeration should have no L. monocytogenes detected in 25 grams.