



## **COORDINATED SAMPLING PROJECT 29 -**

### **Ready-to-Eat Foods for Takeaway or Delivery**

**Conducted April to June 2020 with Local Governments across Western Australia**



**Local Health Authorities Analytical Committee**

**Edith Cowan University**

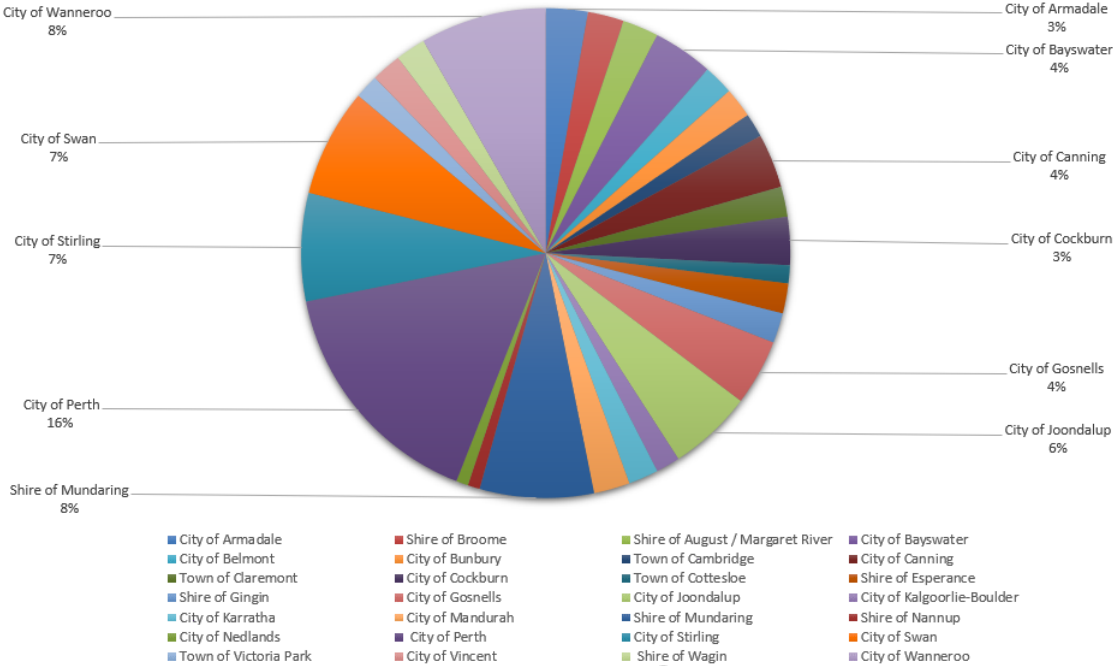
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### Acknowledgements

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Number of Submission of each LGA



## Executive Summary

This study aimed to assess the microbiological quality of ready-to-eat (RTE) food produce sold to the public as takeaway or home delivery.

This study was similar in intent to the CSP 27 study undertaken in October 2019. The main difference was the prevalence of food establishments who began serving takeaway foods in response to restrictions imposed in eating establishments after the outbreak of Covid-19 in Western Australia (WA). Restaurants and food businesses, some with no previous experience with takeaway meals, began providing this option. This CSP was one of several initiatives implemented by food safety practitioners to guarantee high quality takeaway food.

Environmental Health Officers (EHO) submitted samples for assessment to Agrifood Technology (AT) or Eurofins Analytical Reference Laboratory (EARL) from April through June 2020. At the end of the sampling period, 28 Local Government Authorities (LGA) had submitted a total of 252 food samples to the two laboratories 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*) 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 75.7% of samples to be within the satisfactory range, while marginal levels were reported in 14.3% of samples, and unsatisfactory levels were recorded in 10% of samples.

*E. coli* test results indicated 98.8% of samples to be within the satisfactory range, while marginal levels were reported in 1.2% of samples.

Coagulase-positive Staphylococci test results indicated 99.2% of samples to be within the satisfactory range, while marginal levels were reported in 0.8% of samples.

*B. cereus* test results indicated 91.6% of samples to be within the satisfactory range, while marginal levels were reported in 5.6% of samples, and unsatisfactory levels were recorded in 2.8% of samples.

Salmonella spp., as well as L. monocytogenes, test results indicated 99.6% of samples to be within the satisfactory range while marginal levels were reported in 0.4% of samples.

Campylobacter spp. test results indicated 100% of samples to be within the satisfactory range.

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## Abbreviations

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

## 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 Ready-to-Eat (RTE) food for takeaway and delivery.

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. Sandwiches, rolls, stir-fries, baked goods as well as various other RTE foods are widely available in Western Australia (WA).

### 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
<b>Standard Plate Count</b>				
Level 2	<10 <sup>6</sup>	<10 <sup>7</sup>	≥10 <sup>7</sup>	
<b>Indicators</b>				
<i>Escherichia coli</i>	<3	3 – 100	≥100	<sup>a</sup>
<b>Pathogens</b>				
Coagulase +ve staphylococci	<10 <sup>2</sup>	10 <sup>2</sup> – 10 <sup>3</sup>	10 <sup>3</sup> – 10 <sup>4</sup>	≥10 <sup>4</sup> SET +ve
<i>Clostridium Perfringens</i>	<10 <sup>2</sup>	10 <sup>2</sup> – 10 <sup>3</sup>	10 <sup>3</sup> – 10 <sup>4</sup>	≥10 <sup>4</sup>
<i>Bacillus Cereus</i>	<10 <sup>2</sup>	<10 <sup>2</sup> – 10 <sup>3</sup>	10 <sup>3</sup> – 10 <sup>4</sup>	≥10 <sup>4</sup>
<i>Vibrio Parahaemolyticus</i> <sup>b</sup>	<3	<3 – 10 <sup>2</sup>	<10 <sup>2</sup> – 10 <sup>4</sup>	≥10 <sup>4</sup>
<i>Campylobacter</i> spp	Not Detected in 25g			Detected
<i>Salmonella</i> spp	Not Detected in 25g			
<i>Listeria monocytogenes</i> (RTE where growth will not occur) <sup>d</sup>	Not Detected in 25g	Detected but <10 <sup>2</sup> <sup>c</sup>		>10 <sup>2</sup> <sup>d</sup>
<i>Listeria monocytogenes</i> (RTE where growth can occur) <sup>c</sup>	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. This can be considered potentially hazardous particularly if the food needs 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 foods from across WA were submitted to either AT or Eurofins ARL, the two appointed analysts to the LHAAC, between May 2020 and June 2020. 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). Most of the food samples (251) were tested for the presence of *E. coli*, Coagulase-positive Staphylococci, *B. cereus*, *Salmonella* spp., and *L. monocytogenes*, *Campylobacter* spp. One sample was only tested for *L. monocytogenes* (Enumeration).

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 Results

By the end of the sampling period, 28 LGAs had submitted a total of 252 food samples of varying types to the laboratories for analysis. Overall, a total of 1,758 tests were carried out. All 251 samples were tested for the presence of *E. coli*, Coagulase-positive Staphylococci, *B. Cereus*, *Salmonella* spp., *L. Monocytogenes* and *Campylobacter* spp., and 1 sample, which contained pork and rice, was tested for the presence of *Listeria monocytogenes* (Enumeration). 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].**

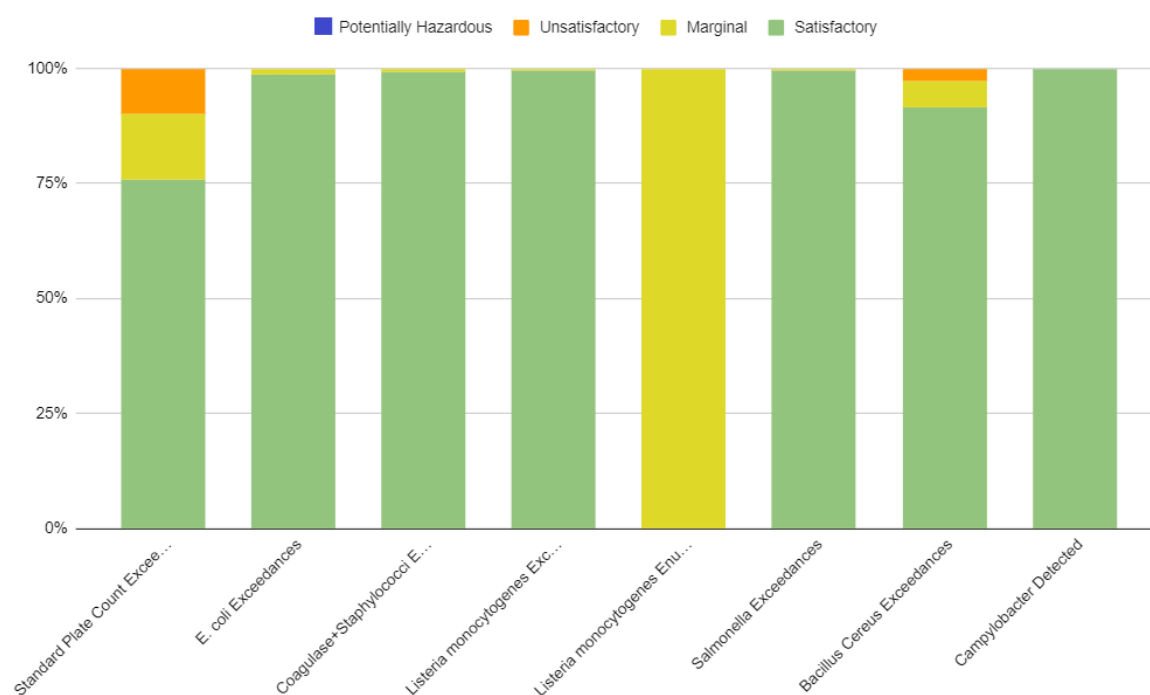
	Microbiological Quality (CFU per gram)			
	Satisfactory	Marginal	Unsatisfactory	Potentially Hazardous
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<i>Clostridium Perfringens</i>	<10 <sup>2</sup>	10 <sup>2</sup> - 10 <sup>3</sup>	10 <sup>3</sup> - 10 <sup>4</sup>	≥10 <sup>4</sup>
<i>Bacillus Cereus</i>	<10 <sup>2</sup>	<10 <sup>2</sup> - 10 <sup>3</sup>	10 <sup>3</sup> - 10 <sup>4</sup>	≥10 <sup>4</sup>
<i>Vibrio Parahaemolyticus</i> <sup>b</sup>	<3	<3 - 10 <sup>2</sup>	<10 <sup>2</sup> - 10 <sup>4</sup>	≥10 <sup>4</sup>
<i>Campylobacter</i> spp	Not Detected in 25g			Detected
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<i>Listeria monocytogenes</i> (RTE where growth will not occur) <sup>d</sup>	Not Detected in 25g	Detected but <10 <sup>2</sup> <sup>c</sup>		>10 <sup>2</sup> <sup>d</sup>
<i>Listeria monocytogenes</i> (RTE where growth can occur) <sup>c</sup>	Not Detected in 25g	Detected	Detected	Detected

Upon analysis, Level 2 Standard Plate Count (SPC) test results indicated 75.7% (n=190) of samples to be within the satisfactory range, while marginal levels were reported in 14.3% (n=36) of samples, and unsatisfactory levels were recorded in 10% (n=25) of samples. *E. coli* test results indicated 98.8% (n = 248) of samples to be within the satisfactory range, while marginal levels were reported in 1.2% (n = 3) of samples. Coagulase-positive Staphylococci test results indicated 99.2% (n = 249) of samples to be within the satisfactory range, while marginal levels were reported in 0.8% (n = 2) of samples. *B. Cereus* test results indicated 91.6% (n = 230) of samples to be within the satisfactory range, while marginal levels were reported in 5.6% (n = 14) of samples, and unsatisfactory levels were recorded in 2.8 % (n = 7) of samples. *Salmonella* spp., as well as *L.*

monocytogenes, test results indicated 99.6% (n = 250) of samples to be within the satisfactory range and while marginal levels were reported in 0.4% (n = 1) of sample.

Listeria monocytogenes Enumeration test results indicated 100% (n = 1) of samples to be within the marginal 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, 94.9% of all test results indicated that the sample was within the satisfactory range, 3.3% indicated marginal levels of microbial contamination, 1.8% 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

TEST	Satisfactory	Marginal	Unsatisfactory	Potentially Hazardous	Total
Standard Plate Count Exceedances	190	36	25	0	251
E. coli Exceedances	248	3	0	0	251
Coagulase+Staphylococci Exceedances	249	2	0	0	251
Listeria monocytogenes Exceedances	250	1	0	0	251
Listeria monocytogenes Enumeration	0	1	0	0	1
Salmonella Exceedances	250	1	0	0	251
Bacillus Cereus Exceedances	230	14	7	0	251
Campylobacter Detected	251	0	0	0	251
<b>Total</b>	<b>1668</b>	<b>58</b>	<b>32</b>	<b>0</b>	<b>1758</b>
<b>Percentage</b>	<b>94.88%</b>	<b>3.30%</b>	<b>1.82%</b>	<b>0%</b>	<b>100%</b>

## 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].

251 samples were assessed as being in the level 2 category of SPC. The results for these products ranged from <200 to  $1.8 \times 10^8$  cfu/g. 36 samples (14.3%) were in the marginal range and a total of 25 samples (10%) were in the unsatisfactory range.

However 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 to a salad or salad roll where there is no SPC limit due to inherently high plate count because of the normal microbial flora. Due to the coordination of the survey by LHAAC a level was chosen for the SPC results, although some individual samples may have been more appropriately assigned a different level.

### 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 248 of 251 samples (98.8%) which were tested for the presence of *E. coli* fell within satisfactory levels when compared against the microbiological guidelines from FSANZ [1]. 3 samples (1.19%) 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 249 of 251 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]. 2 samples (0.8%) indicated marginal levels. This result suggests most of the food outlets have taken care in both the preparation and in the cooking process of the RTE meals.

#### **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 frequently 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 230 of 251 samples (91.6%) which were tested for the presence of *B. cereus* fell within satisfactory levels when compared against the microbiological guidelines from FSANZ [1]. 14 samples indicated marginal levels (5.6%) and 7 samples (2.8%) reported in unsatisfactory level.

An assessment was not undertaken on the type of food being tested or whether the *B. cereus* results could have been a detection of *B. thuringiensis* which is more likely to be present in foods with salad type ingredients due to the bacteria being used as a biological pesticide in organic farming.

#### **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 251 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 250 samples which were tested for the presence of Salmonella spp. fell within satisfactory levels when compared against the microbiological guidelines from FSANZ. Only 1 sample reported a marginal result (0.4%).

#### **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 250 samples which were tested for the presence of *L. monocytogenes* fell within satisfactory levels when compared against the microbiological guidelines from FSANZ. Only 1 sample

reported a marginal result (0.4%). Another 1 sample was detected <10 CFU/g in *Listeria monocytogenes* Enumeration. 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 foods. Continued education on safe food handling procedures will assist in preventing the spread of *L. monocytogenes* in food businesses [19].

## 5.0 Conclusion

This CSP looked at the microbiological quality of RTE food products for takeaway or delivery. Most of the samples were tested for the SPC and the presence of *E. coli*, coagulase-positive *Staphylococci*, *B. cereus*, *Salmonella* spp., and *L. monocytogenes*, *Campylobacter* spp.

Based on the results, there were no potentially hazardous food samples which indicated no immediate food safety concerns. The results demonstrated that the vast majority (94.88%) of test results were within satisfactory levels of microbiological quality when assessed against FSANZ's microbiological guidelines for RTE food. 3.3% were marginal and 1.8% were unsatisfactory. There were no potentially hazardous cases. These results indicate safe food practices were being implemented by the food businesses.

Overall, approximately 95% of the food sample tests showed satisfactory results in this study [Table 2]. This reflects well on the WA food industry during difficult times, who demonstrated they provide good quality RTE meals for takeaway and delivery to consumers in WA. 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, who have legislative responsibility for Food Safety in WA.



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## Appendix A

### Raw Data

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

Local Health Authorities Analytical Committee

Edith Cowan University

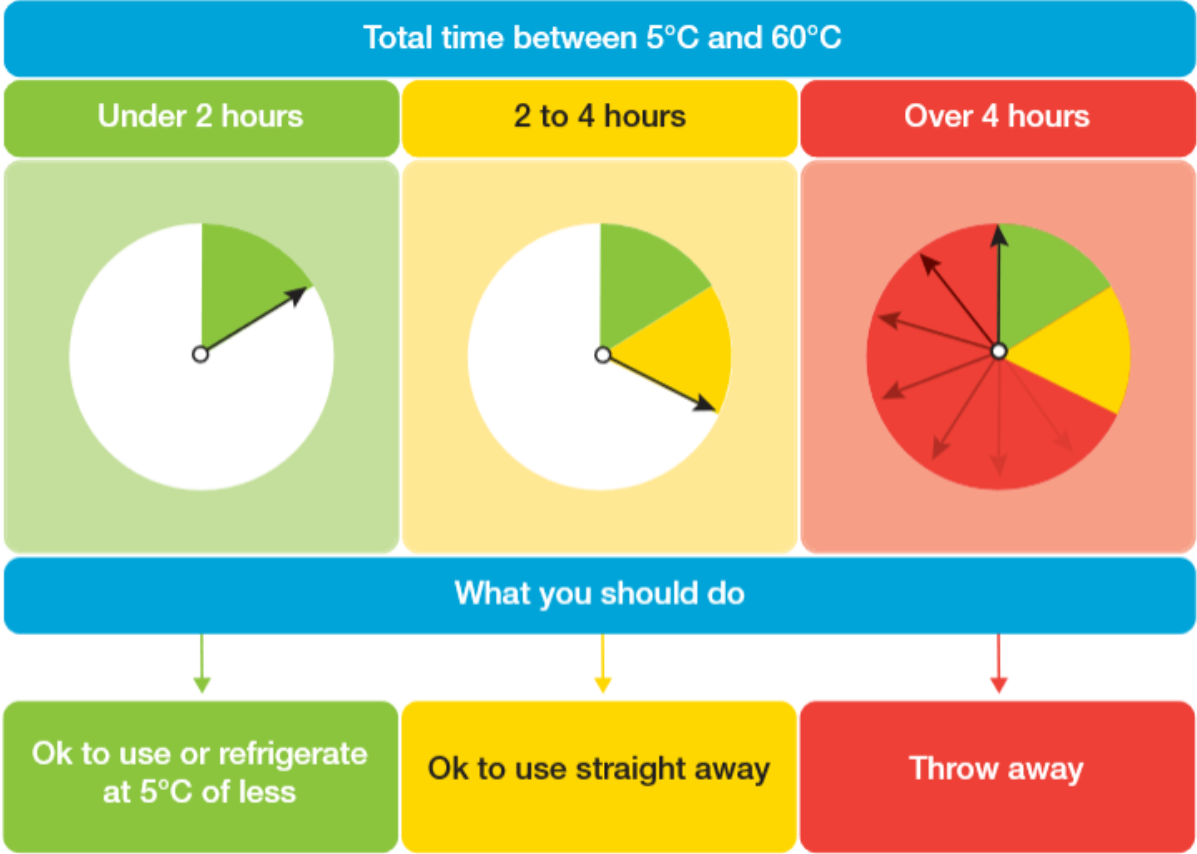
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Appendix B



The total time includes all the time the food has been at room temperature, for example during delivery, display, preparation and transportation.

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
<b>Standard Plate Count</b>				
Level 2	<10 <sup>6</sup>	<10 <sup>7</sup>	≥10 <sup>7</sup>	
<b>Indicators</b>				
<i>Escherichia coli</i>	<3	3 – 100	≥100	<sup>a</sup>
<b>Pathogens</b>				
Coagulase +ve staphylococci	<10 <sup>2</sup>	10 <sup>2</sup> - 10 <sup>3</sup>	10 <sup>3</sup> - 10 <sup>4</sup>	≥10 <sup>4</sup> SET +ve
<i>Clostridium Perfringens</i>	<10 <sup>2</sup>	10 <sup>2</sup> - 10 <sup>3</sup>	10 <sup>3</sup> - 10 <sup>4</sup>	≥10 <sup>4</sup>
<i>Bacillus Cereus</i>	<10 <sup>2</sup>	<10 <sup>2</sup> – 10 <sup>3</sup>	10 <sup>3</sup> - 10 <sup>4</sup>	≥10 <sup>4</sup>
<i>Vibrio Parahaemolyticus</i> <sup>b</sup>	<3	<3 - 10 <sup>2</sup>	<10 <sup>2</sup> - 10 <sup>4</sup>	≥10 <sup>4</sup>
Campylobacter spp	Not Detected in 25g			Detected
Salmonella spp	Not Detected in 25g			
<i>Listeria monocytogenes</i> (RTE where growth will not occur) <sup>d</sup>	Not Detected in 25g	Detected but <10 <sup>2</sup> <sup>c</sup>		>10 <sup>2</sup> <sup>d</sup>
<i>Listeria monocytogenes</i> (RTE where growth can occur) <sup>c</sup>	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 (<10<sup>2</sup> 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.