COORDINATED SAMPLING PROJECT (CSP) 38 –

CAMPYLOBACTER DETECTIONS IN READY-TO-EAT CHICKEN PRODUCTS

Conducted November 2023 – February 2024 with Local Governments across Western Australia

Local Health Authorities Analytical Committee

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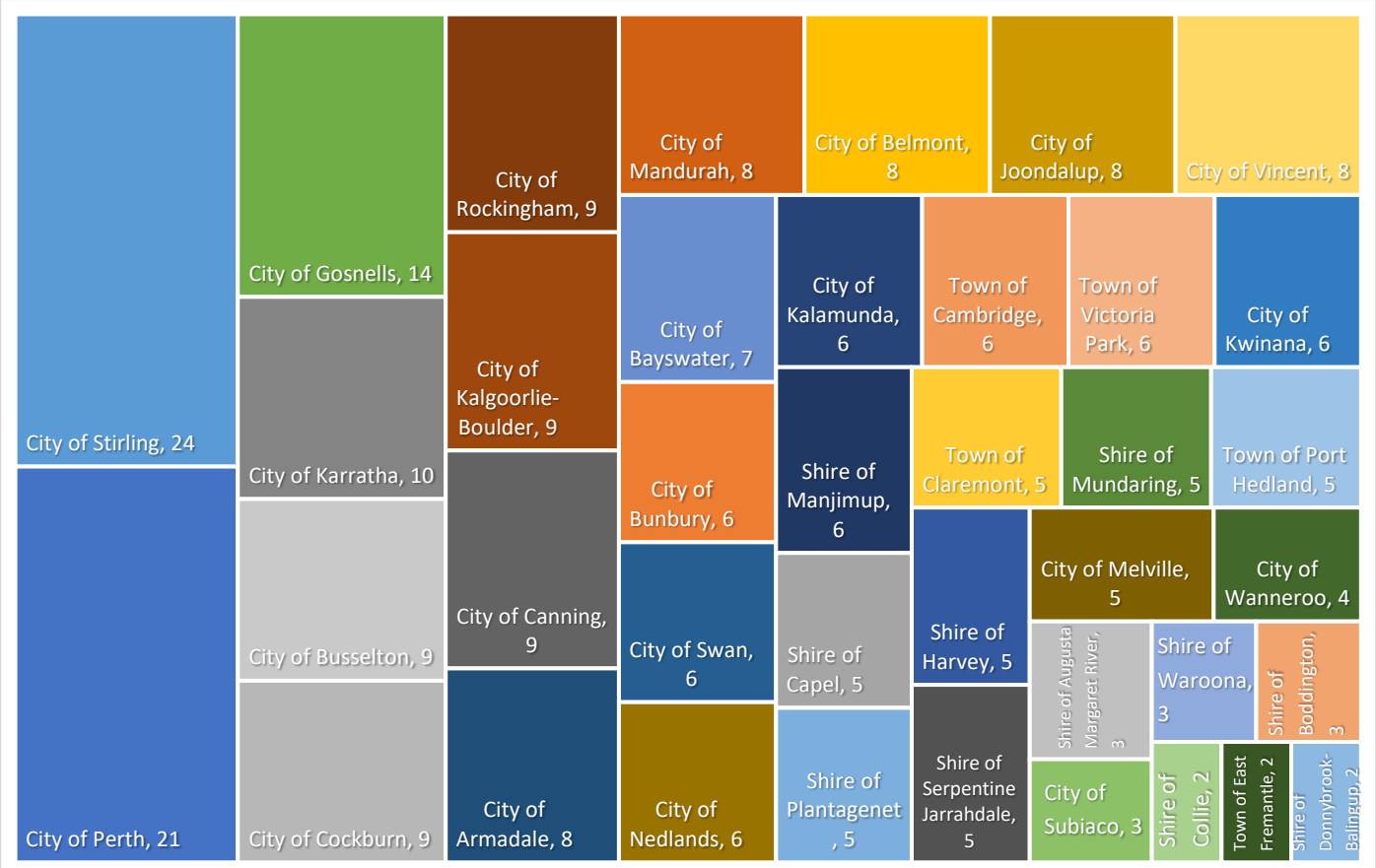
Figure 1 - Number of samples submitted by each LGA



Executive Summary

This CSP aims to examine the microbial safety of ready-to-eat (RTE) chicken products available from food businesses in WA such as delis, lunch bars, fast food chains, petrol stations, and other premises that serve these products.

According to the Western Australian Department of Health, *Campylobacter* bacteria is the most prevalent source of food-borne illness in WA, with over 4,000 notified cases in 2022 (Department of Health, 2023). Chicken meat is the most common food source of *Campylobacter*, with approximately 80% of Australian campylobacteriosis cases in 2017 - 2019 attributed to eating chicken (McLure et al., 2023). To manage the risk of food-borne illness, it is essential that monitoring take place at all levels of food production, including local supply of foods to consumers.

Sample testing was conducted by Agrifood Technology and Eurofins ARL, which tested for *Campylobacter*, as well as standard plate count and *Escherichia coli*. Some samples were also tested for coliforms.

In general, the results from this CSP were encouraging, with only one sample found to contain *E. coli* and one sample containing *Campylobacter* out of 272 samples, resulting in 99.3% of samples without positive microbial detection. There were a number of high standard plate count results, though these are likely to be non-pathogenic yeasts, lactobacilli and other food related microbes.

As a result of this survey, LGAs should consider:

- Reviewing the sample results and determine if further action is required. This determination should include a review of the Analyst results against the relevant Code provisions and consider your local governments' compliance and enforcement strategy.
- Informing the retail outlet of any non-compliant results.
- Factors that can guide further action including whether quantities of the food remain in storage and have not yet been sold, if food is sold at other locations or is subsequently packaged and sold for catering purposes.
- If the product is manufactured outside of your local government area, it is suggested that you write to the manufacturer and the relevant Local Government.

Detailed results from this CSP are available upon request. Please contact LHAAC for more information.

Contents

List of Abbreviations

ARL	Analytical Research Laboratory
CSP	Coordinated Sampling Project
DoH	Department of Health
FSANZ	Food Standards Australia and New Zealand
FSC	Australia New Zealand Food Standards Code
LGA	Local Government Authorities
LHAAC	Local Health Authorities Analytical Committee
NATA	National Association of Testing Authorities
RTE	Ready-to-eat
SPC	Standard plate count
WA	Western Australia

1.0 Introduction

According to the Western Australian Department of Health (DoH), *Campylobacter* bacteria is the most prevalent source of food-borne illness in WA, with over 4,000 notified cases in 2022. This is likely to be under-reported, with estimates placing actual cases at nearly ten times the number of notified cases (Department of Health, 2023). Chicken meat is the most common food source of *Campylobacter* transmission, with approximately 80% of Australian campylobacteriosis cases in 2017 - 2019 attributed to eating chicken (McLure et al., 2023). The unsafe handling, preparation and consumption of chicken all pose potential risk of exposure to *Campylobacter*. Symptoms may be mild, but may require hospitalisation in severe cases and is associated with the development of long term conditions such as Guillain-Barré Syndrome, Reactive Arthritis and Irritable Bowel Syndrome (Myintzaw et al., 2023) – therefore preventing exposure is important for protecting the community.

To manage the risk of food-borne illness, it is essential that monitoring take place at all levels of food production, including local supply of foods to consumers. As Local Government Authorities (LGAs) manage the food safety practices of over 24,000 food businesses in WA, this provides an ideal means to intervene and ensure food safety for consumers (Department of Health, 2023).

Advice from the WA DoH was that a gap in relevant data exists when examining the exposure sources of *Campylobacter* specific to chicken products. It remains unclear whether the risk is greater from chicken products cooked and consumed in a domestic setting or prepared for consumption at a food business. To narrow the scope of this survey, the focus was set to Ready-to-eat (RTE) chicken products available from food businesses as these do not require any further cooking before being consumed. In addition, often these products once cooked, may be stored at controlled temperatures to be handled or assembled with other ingredients into another food product that is not cooked further (such as a sandwich) for future consumption. The risk of exposure to foodborne pathogens increases when RTE products are not adequately cooked or if stored outside safe temperature ranges.

Given the high risk of *Campylobacter* exposure posed by chicken products, this Coordinated Sampling Project (CSP) aims to profile the food safety risk in businesses serving RTE chicken products, with the view to of using this data to formulate interventions to reduce campylobacteriosis cases.

2.0 Project aim

This Coordinated Sampling Project (CSP) aims to examine the microbial safety of ready-to-eat (RTE) chicken products available from food businesses in WA such as delis, lunch bars, fast food chains, petrol stations, and other premises that serve these products. The results of this CSP profiles the food safety risk in the food service sector, and findings are intended to help formulate future interventions to reduce campylobacteriosis cases.

3.0 Methodology

Sampling instructions were supplied to all WA LGAs. Both metropolitan and non-metropolitan LGAs were encouraged to participate in this CSP.

The sampling instructions explained the risks of microbial pathogens that can be found in chicken products (such as *Campylobacter* spp.), and asked LGAs to submit chicken products from delis, lunch bars, fast food chains, petrol stations, and other premises that serve these products in their area for testing between 27 November 2023 – 23 February 2024.

LGAs were instructed to focus on RTE chicken products – with a specific focus on chicken kebabs; crumbed/battered deep fried chicken; chicken dishes served slightly cooked or raw; chicken dishes that use comminuted chicken or mince-meat (e.g. sausage, nuggets, patties); and sliced, chopped or shredded chicken in a RTE product (e.g. sandwich, salads). LGAs were asked to avoid sampling roast chickens from major supermarkets, products from major food franchises and chicken that is not ready to eat and requires additional cooking – unless these businesses had been found to have poor food handling procedures in the past.

Sample testing was conducted by Agrifood Technology and Eurofins ARL, using their standard NATA accredited protocols, which tested for *Campylobacter* spp (*Campylobacter*), as well as standard/total plate count and *Escherichia coli* (*E. coli*). Some samples were also tested for general and thermotolerant coliforms as indicators for other faecal contamination. Further post-test data analysis was conducted using Microsoft Excel.

Each sample was classified into a standard plate count (SPC) category where possible. As a determination was not made by LGAs or Analyst for each sample's SPC category, this was done post-testing based on the name of the sample – some samples' categories could not be determined and have been labelled 'unknown'.

Microbiological results were assessed against the FSANZ microbiological standards in Table 1 below.

Table 1 - Guideline levels for determining the microbiological quality of food products

	Satisfactory (cfu/g)	Marginal (cfu/g)	Unsatisfactory (cfu/g)	Potentially Hazardous
Standard Plate Count				
Category 1 Applies to foods fully cooked for immediate sale or consumption.	$<10^3$	10^3 - $<10^5$	$\geq 10^5$	NA
Category 2a Applies to foods in which all components of the foods have been cooked but there is minimal handling or storage before sale or consumption.	$<10^4$	10^4 - $<10^6$	$\geq 10^6$	NA
Category 2b Applies to foods in which all components of the foods have been cooked but there is minimal handling and the food is packaged for extended refrigerated shelf life.	$<10^4$	10^4 - $<10^7$	$\geq 10^7$	NA
Category 3 Applies to foods in which all components of the foods have been cooked and there is some handling and/or refrigerated storage before sale or consumption.	$<10^5$	10^5 - $<10^7$	$\geq 10^7$	NA
Category 4 Applies to foods that contain some components that have not been cooked.	$<10^6$	10^6 - $<10^7$	$\geq 10^7$	NA
Category 5 Foods in Category 5 either have an inherently high plate count because of the normal microbial flora present or as a result of the processing received. Includes fermented, preserved and dried food products and fresh fruit and vegetables.	NA	NA	NA	NA
Escherichia coli (e coli)				
	<3	3 – $<10^2$	$>10^2$	NA
Campylobacter spp				
	Not detected in 25g	NA	NA	Detected in 25g
Enterobacteriaceae (includes coliforms)				
	$<10^2$	10^2 – 10^4	$>10^4$	NA

Values sourced from FSANZ (FSANZ, 2022).

The categories ‘satisfactory’, ‘marginal’, ‘unsatisfactory’ and ‘potentially hazardous’ provide guidance on interpreting microbiological tests:

- Satisfactory: results are within expected microbiological levels (lower range) and present no food safety concern. No action required.
- Marginal: results are within expected microbiological levels but are at the upper range. Some action may be required to ensure food handling controls continue to be effective.
- Unsatisfactory: results are outside expected microbiological levels and indicate poor food handling practices. Further actions are required to re-establish effective food handling controls.
- Potentially hazardous: results exceed expected microbiological levels to a level that presents an immediate food safety concern. Further action is required to:
    - prevent affected product still available from being distributed or sold.
    - determine the likely source/cause of the problem and ensure corrective actions are implemented (FSANZ, 2022).

In addition to the microbiological tests above, samples were categorised by retailer and food type. In some cases the sample labelling did not contain enough detail to assign these categories, therefore samples were labelled ‘undescribed’ for an unknown retailer, or ‘unknown; for an unknown food type.

4.0 Results

A total of 272 samples were submitted for testing by 39 Western Australian LGAs. Only two samples were of concern (See table 2 and 3).

Table 2: Campylobacter results

	Test results	Percentage of total
Total number of samples	272	
Satisfactory	271	99.6%
Potentially hazardous	1	0.4%

Table 3: E coli results

	Test results	Percentage of total
Total number of samples	272	
Satisfactory	119	43.8%
Marginal	152	55.9%
Unsatisfactory	1	0.4%

Of these samples, one sample contained unsatisfactory levels of *E. coli* bacteria, which was a sushi product from an undescribed retailer. *Campylobacter* was detected in one sample, which was a meat only product from an undescribed retailer. *E. coli* and *Campylobacter* were not detected in the remainder of the samples – though there were a large number of marginal *E. coli* results (n = 152, 55.9%).

Table 4: Standard Plate Count (SPC) results

	Category 1	Category 2a	Category 2b	Category 3	Category 4	Category 5*	Category Unknown*	Total
Total	139	2	14	2	92	*9*	*14*	272
Satisfactory	84 (60.4%)	2 (100.0%)	8 (57.1%)	1 (50.0%)	61 (66.3%)	NA	NA	156 (57.4%)
Marginal	31 (22.3%)	0	2 (14.3%)	0	12 (13.0%)	NA	NA	45 (16.5%)
Unsatisfactory	24 (17.3%)	0	4 (28.6%)	1 (50.0%)	19 (20.7%)	NA	NA	48 (17.6%)

*Category 5 foods do not have reference ranges for satisfactory, marginal and unsatisfactory results due to inherently high plate counts. For unknown category foods the reference ranges cannot be determined and are therefore not applied.

Nine samples were identified as Category 5 (detail which type or types these were) and therefore due to their ingredient composition or preparation process involving naturally occurring or beneficial microbes, these products are expected to have higher than average plate counts, e.g. lactobacilli in dairy products.

In addition to *E. coli* and *Campylobacter* samples had the SPC method applied, and just under half of the samples also tested for general and thermotolerant coliforms (n=121).

Across all SPC categories, 57.4% of samples were in a satisfactory SPC range, 16.5% were in a marginal SPC range and 17.6% were in an unsatisfactory range. Compliance was high in the two largest SPC categories of category 1 (n=139) and category 4 (n=92), with 60.4% and 66.3% respectively falling into their category's satisfactory range. Category 2b samples had the poorest compliance at 28.6% in an unsatisfactory range, though only 14 samples were classified in this category.

Table 5: Retailers and standard plate count results

Retailer	Total	Satisfactory	Marginal	Unsatisfactory	Unknown or NA
Undescribed	125	80 (64.0%)	20 (16.0%)	14 (11.2%)	11 (8.8%)
Café or takeaway	87	41 (47.1%)	15 (17.2%)	21 (24.1%)	10 (11.5%)
Restaurant	20	10 (50.0%)	6 (30.0%)	3 (15.0%)	1 (5.0%)
Supermarket	19	11 (57.9%)	2 (10.5%)	5 (26.3%)	1 (5.3%)
Petrol Station	14	8 (57.1%)	2 (14.3%)	4 (28.6%)	0
Chain fast food	7	6 (85.7%)	0	1 (14.3%)	0
Total	272	156 (57.4%)	45 (16.5%)	48 (17.6%)	23 (8.5%)

There were a large number (n=125, 46.0%) of undescribed retailers. Of samples able to be categorised as being sold by a particular retailer, chain fast food was by far the most likely to be satisfactory (85.7%) for standard plate count results, though there were only 7 samples submitted in this sampling project.

Supermarkets (n=19) and petrol stations (n=14) were the next most likely retailers to have satisfactory standard plate counts at 57.9% and 57.1% of samples respectively. Conversely, petrol stations (28.6%) and supermarkets (26.3%) were also most likely to have unsatisfactory standard plate count results, with fewer marginal results than other retailers.

This polarisation of standard plate count results for these retailers presents a challenge for public health interventions. With some samples performing well and some samples performing poorly for standard plate count in the same environment, this may indicate that further investigation is required.

Table 6: Food type and standard plate count results

Food type	Total	Satisfactory	Marginal	Unsatisfactory	Unknown/NA
Cooked meal	56	29 (51.8%)	15 (26.8%)	12 (21.4%)	0
Fried RTE	50	36 (72.0%)	10 (20.0%)	4 (8.0%)	0
Sandwich	44	22 (50.0%)	8 (18.2%)	12 (27.3%)	2 (4.5%)
Kebab	23	16 (69.6%)	3 (13.0%)	4 (17.4%)	0
Meat only	18	5 (27.8%)	3 (16.7%)	2 (11.1%)	8 (44.4%)
Schnitzel	16	10 (62.5%)	2 (12.5%)	4 (25.0%)	0
Sushi	14	13 (92.9%)	0	1 (7.1%)	0
Burger	13	10 (76.9%)	1 (7.7%)	2 (15.4%)	0
Unknown	13	4 (30.8%)	0	3 (23.1%)	6 (46.2%)
Heat-and-eat	9	5 (55.6%)	1 (11.1%)	3 (33.3%)	0
Salad	8	1 (12.5%)	0	0	7 (87.5%)
Soup	6	3 (50.0%)	2 (33.3%)	1 (16.7%)	0
Pie	2	2 (100.0%)	0	0	0
Total	272	156 (57.4%)	45 (16.5%)	48 (17.6%)	23 (8.5%)

When sample standard plate counts are categorised by their food type, the most likely categories to have satisfactory levels of standard plate count are sushi or rice paper rolls (92.9%), burgers (76.9%) and fried goods (72.0%). Pies also performed well (100%), however have a sample size of 2 and so this result must be interpreted with caution. Heat-and-eat meals (33.3%), sandwiches and wraps (27.3%) and schnitzels (25.0%) were the most likely samples with standard plate count results in the unsatisfactory range.

Table 7: Coliforms results

	Test results	Percentage of total
Total number of samples	121	100%
Satisfactory	116	95.9%
Marginal	5	4.1%
Unsatisfactory	0	0%

Of the samples tested for coliforms, 95.9% were in a satisfactory range, 4.1% were in a marginal range and none were in the unsatisfactory range.

5.0 Discussion

In general, the results from this CSP were encouraging, with only one detection of *E. coli* and one detection of *Campylobacter* out of 272 samples, resulting in 99.3% of samples having non detections of pathogenic bacteria (within the survey limits). The low rates of detection levels of *E. coli* (n=1, 0.4%) and *Campylobacter* (n=1, 0.4%) bacteria found in the samples are promising results.

On further investigation, the detection of *Campylobacter* was found to be a product that was described as 'partially cooked chicken' and was to be cooked further before consumption by the customer. However, this was being treated like a fully cooked product and stored in a bain-marie with other products, although separated. Further testing of the fully cooked chicken product and other bain-marie products did not yield microbial detections for *Campylobacter.* The LGA reviewed the business's procedures and educated them to reduce the risk of cross contamination. This finding does confirm that half cooked or raw chicken products are likely to be a source of exposure to *Campylobacter* bacteria – of all the samples tested, this one did produce a positive result.

Campylobacter detection rates in Australia are amongst the highest of developed countries (Wallace et al., 2020), however based on the results of this CSP it would seem that RTE chicken products in the local context is unlikely to be a significant source of *Campylobacter* transmission. While the very low number of microbial detections are encouraging, this singular result does not provide much information about sources or trends of *Campylobacter* bacteria in foods. Further studies will be needed to better analyse the broader sources of *Campylobacter* contamination in foods in the local context.

There were a number of marginal *E. coli* results (n=152, 55.9%). Marginal results indicate expected microbiological levels in foods, but are pushing towards the upper range of acceptability. If marginal results are observed in several foods or throughout a food preparation area at a business, this may indicate poor food-handling, preparation or storage practices need to be addressed. This differs from

unsatisfactory results, which are outside expected microbiological ranges and likely indicate poor hygiene and food handling practices. Further investigation and action is needed to establish improved hygiene and food handling controls (FSANZ, 2022). In the context of these results, further investigation is required to determine what interventions (if any) are needed to increase food safety practices from these food retailers.

Standard plate count results were mixed, with some high SPCs across a variety of products. The highest standard plate count recorded was 2.1 x 10^8 CFU/g in a chicken roll from a café/takeaway business. The satisfactory threshold for this category 4 sample is less than 1 x 10^6 CFU/g. SPC is generally used as a test of the microbiological quality of foods and while there are standards for SPC, high plate counts may not indicate the presence of pathogenic microorganisms. Some foods, such as raw fruits, vegetables, unprocessed raw foods, fermented, dairy and baked goods can be expected to have high SPC counts due to the microbial flora naturally present or used in the manufacturing processes (FSANZ, 2022). In the context of this CSP, the high plate counts are more likely to be non-pathogenic yeasts, lactobacilli and other food related microbes.

Restaurants and chain fast food retailers had the fewest unsatisfactory SPC results at 15% and 14.3% of results respectively. This may be due to stronger food control practices or procedures, better trained staff or less risky products sold by these businesses. The notable gap between these retailers and the next lowest unsatisfactory result for cafes/takeaway (24.1%) may indicate good food safety practices that should be emulated in other business, and this should be investigated further.

Heat-and-eat meals and sandwiches were more likely to have unsatisfactory standard plate count results, with 33.3% and 27.3% respectively. Noting that sandwiches generally contain raw vegetables, dairy and baked goods, the higher SPC result is expected due to the microbial flora present in these products, though further investigation would be needed to determine if this were the case, or if contamination may be causing the SPC results. Interestingly, kebabs and burgers were much less likely to return an unsatisfactory result compared to sandwiches (17.4% and 15.4% respectively). It is possible that the cooked component of these otherwise similar products helps reduce SPC, or as these are generally made to order, they may not be stored for as long. All heat-and-eat meals were sold in supermarkets, which means they may sit on a shelf for some time before being bought and cooked at home. In heat-and-eat meals, high CSP results may be more concerning as we can expect less microbial flora in the sample due to the pre-cooking process, meaning contamination may be more likely. Businesses should be aware of the risk factors for products with certain ingredients, and prepared and stored in certain ways – LGAs can work with these businesses to provide further education about safe food practices to mitigate this risk.

The participation rate of LGAs in this CSP was good, with many of the larger metropolitan LGAs participating and several regional LGAs submitted samples. This resulted in a large number and diversity of samples from different contexts, which increases the quality of the results.

5.1 Limitations

The SPC category of sample, as well as their 'food type' and 'retailer' categories were inferred from sample data information, and while care was taken to select the correct category, this may be inaccurate.

The sampling occurred as a point-in-time collection of data and may not be applicable for broad generalisations across the food industry.

6.0 Conclusion

The results from this CSP were encouraging, with only one detection of *E. Coli* from a single sample and one detection of *Campylobacter* in a single sample out of 272 samples, resulting in 99.3% of samples with non-detections of pathogenic microbes (within the survey limits). This CSP does not provide significant information about key exposure sources of *Campylobacter* bacteria in foods and further studies will be needed to better analyse the sources of *Campylobacter* contamination in foods.

While the few unsatisfactory SPC results may be concerning for certain products or businesses, overall, the results are a general indication that RTE chicken products in WA are considered safe and suitable for consumption.

7.0 References

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