LHAAC
LOCAL HEALTH AUTHORITIES ANALYTICAL COMMITTEE

COORDINATED SAMPLING PROJECT 20

Antibiotic and Heavy Metal Residues in Seafood Products

Conducted May through June 2017 with Local Government's across Western Australia

December 2017

Local Health Authorities Analytical Committee

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Executive Summary

This Coordinated Sampling Project focused on antimicrobial and heavy metal residues in seafood. The Local Health Authorities Analytical Committee (LHAAC) and Local Government Authorities (LGA) worked in concert to execute this project. It is essential that Western Australians have access to seafood from local and imported sources that meet the standards set for antimicrobial residues, heavy metal residues and labelling standards.

The purpose of this project was to provide a snapshot of the state of compliance with the Food Standards Code in regards to antimicrobial and heavy metal residues in seafood for both imported and locally produced products. This project was executed through Environmental Health Officers at LGA's throughout Western Australia submitting seafood samples for analysis to ChemCentre from May 2016 through to June 2016.

At the end of the sampling period 301 samples had been submitted for assessment by LGA's throughout Western Australia. Of these 301 samples only one sample was identified as inconsistent for antimicrobial residues and 13 for heavy metal residues. This indicates a 99.77% compliance rate for antimicrobial residues and 95.68% compliance for heavy metal residues. Of the 13 samples identified inconsistent for heavy metal residues 9 of these were swordfish. There was no difference in compliance observed based on country of origin or type of seafood product assessed. 60 labelling inconsistencies were identified in this CSP with 71.76% due to the absence of an allergen warning or seafood declaration.

This sample was reasonably sized and diverse in terms of products and locations sampled which lends strength to the results of this project. This CSP's results also support the findings of the Department of Agriculture and Water Resources in regards to the high degree of compliance in antimicrobial and heavy metal residues in Australian seafood products (Australian Department of Agriculture and Water Resources, 2017). LGA's with inconsistent samples were notified and appropriate action taken to ensure the continued compliance with the Food Standards Code.

Contents

List of abbreviations

Coordinated Sampling Project (CSP)

Food Standards Australia and New Zealand (FSANZ)

Food Standards Code (FSC)

Local Government Authorities (LGA)

Local Health Authorities Analytical Committee (LHAAC)

Background

In 2008 the Department of Agriculture and Water Resources conducted a Survey of Chemicals in imported seafood which tested 100 samples for residues of 88 agricultural and veterinary compounds. This survey found 31 antimicrobial residues in the 100 samples, however these residues were at low levels and posed no significant safety concerns (Australian Department of Agriculture and Water Resources [ADAWR], 2008). However, the report did note that the Expert Advisory Group on Antimicrobial Resistance (EAGAR) did raise concerns about the presence of these residues and their potential contribution to the development of antibiotic resistance. The high prevalence of antimicrobial resistance observed in aquaculture bacterial isolates from Vietnam and worldwide aquatic environments reflects the use of antibiotics in aquaculture. These aquatic farms could become pools of resistant genes against antibiotics used in humans (Nguyen, Van, & Coloe, 2016).

According to Australia's First National Antimicrobial Resistance Strategy 2015-2019 the proportion of antibiotics prescribed to food producing animals accounts for 4% of the volume of antimicrobials prescribed with 43% as prophylactic treatment and 51% used for control of coccidiosis in chickens. This compares very favourably to other countries, some of whom provide much of Australia's seafood supply. China, for example, has an antibiotic use on animals of 52%, which is greater than the usage rate on humans (Qiao, M.,Ying, G.-G., Singer, A. C.,& Zhu, Y.-G.(2018). The use of antimicrobials in farm animals, particularly those antimicrobials also used for human medicine, is an important step in ensuring the continued availability of appropriate antimicrobial therapy for the management of human illness (Department of Health. Department of Agriculture, 2015).

In 2016-17 the Department of Agriculture and Water Resources conducted the National Residue Survey. This program ensures fish exports and imports meet the necessary requirements, supports industry quality assurance initiatives and enables domestic fish processing facilities to satisfy the relevant regulations and licences. The 2016-17 survey sampled 138 aquaculture and 70 wild caught fish samples and analysed them for compliance with Australian standards including antibiotic and heavy metals. Aquaculture fish had a 98.55% compliance rate and wild caught had a 100% compliance with Australian standards (ADAWR, 2017).

Chiocchetti, Jadán-Piedra, Vélez and Devesa (2016) reviewed the prevalence of metalloids in seafood products and advocated for the routine surveillance of these compounds by countries for the protection of consumers and further research into the bioavailability, metabolism and effects of pre and post processing on these compounds.

In order to respond to the concern and provide a current cross section of metalloid and antimicrobial residues in both imported and local seafood products LHAAC implemented the CSP20 on Antimicrobial and Heavy Metal Residues.

Introduction

LHAAC works in collaboration with Local Government Authorities to aid in the upkeep of the Food Standards Code throughout Western Australia. One of the ways this is achieved is through CSP's. LHAAC chooses the focus for CSP's based on routine surveillance, response to public trends and evidence of non-compliance. The standard 1.4.1 and schedule19 outlines the maximum levels of contaminants and natural toxicants including heavy metals allowed in food. Standard 1.4.2 and schedule 22 outline the maximum residue limits for antibiotic residues in food. Furthermore Schedule 22 outlines the classification of foods for the FSC (FSANZ, 2017). This CSP aimed to observe a cross section of imported and local seafood and determine the compliance of samples to these two standards and to identify any differences in compliance between local or imported seafood products. This CSP also assessed products against standard 1.2 labelling requirements.

Methodology

LGA's were supplied with a set of sampling instructions and submitted samples from May through June of 2017. A minimum sample size of 250g or 250ml was set and LGA's were instructed to target their sampling towards tuna, shark, mackerel or swordfish due to predators being known accumulators of heavy metals (Liess, Gerner, & Kefford, 2017). As well as shell fish, discretionary seafood products such as prawn balls or fish fingers and sauces containing seafood were included. Samples were to be submitted by LGA's to ChemCentre (one of two LHAAC appointed analysts) for assessment against the relevant food standards. Testing was conducted for heavy metal residues of arsenic, inorganic arsenic, cadmium, lead and mercury. Antibiotic residue testing included amoxicillin, oxytetracycline, sulphamethoxazole, ampicillin, trimethoprim, erythromycin, cephalothin and cephalexin. Samples were also assessed for labelling requirements including content, formatting and legibility. Table 1 below demonstrates the standards applied for heavy metals and antibiotic residues for Fish, Crustaceans and Molluscs as defined in the FSC, where 0 indicates a standard of no detectable level and a "-" implying the level should be "as low as reasonably achievable."

Table 1
Limits for heavy metals and antibiotic residues in seafood
Note: LOR = Limit of reporting

Analyte	LOR	Fish	Crustaceans	Molluscs
Arsenic	0.01	-	-	-
Inorganic arsenic	0.1	2	2	1
Cadmium	0.001	-	-	2
Lead	0.005	0.5	-	2
Mercury	0.01	1.5	1.5	1.5
Amoxicillin	0.02	0	0	0
Ampicillin	0.03	0	0	0
Oxytetracycline	0.02	0.2	0	0

Sulphamethoxazole	0.02	0	0	0
Trimethoprim	0.02	0	0	0
Erythromycin	0.01	0	0	0
Cephalothin	0.01	0	0	0
Cephalexin	0.03	0	0	0

Results

At the end of the sampling period 301 samples had been submitted by LGAs across WA (see Appendix A) for assessment by ChemCentre. Of the 301 samples submitted a total of 74 samples were inconsistent with the FSC.

Antibiotics

There was a total of 2408 tests applied to seafood samples for antibiotic residues. Of these tests 99.96% were consistent with the FSC with no antimicrobial residue levels reaching detectable levels. Only one test originating from Thailand was found to be inconsistent, containing above the detectable limit of erythromycin. Furthermore, of the 301 samples submitted for assessment, there was a 99.77% compliance with the FSC when assessed on a per sample basis.

Heavy Metals

There was 1,505 tests applied to samples for compliance with the standards for heavy metal residue. There was a 99.14% compliance rate with the standards for heavy metals with only 13 samples breaching the standards set by the FSC. When assessed on a per sample basis there was a 95.68% compliance rate.

As shown in Figure 1 below the majority of heavy metal inconsistencies were mercury followed by arsenic; with mercury exceeding the 1.5mg/kg in 11 samples and arsenic present at a detectable level in 2 samples.

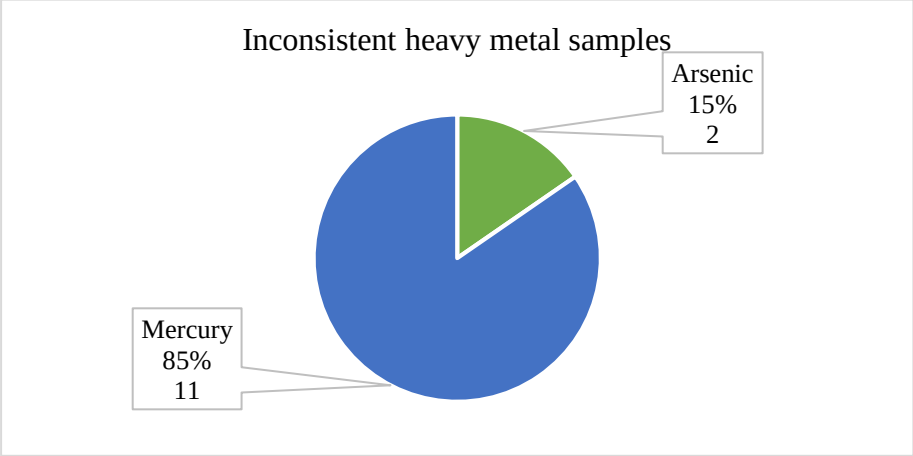

Figure 1: Inconsistent heavy metal samples

Nine of the 13 samples inconsistent were swordfish. The compliance rate for all swordfish samples submitted (n=11) was 18.2%.

The proportion of total heavy metal and antibiotic residue compliance in Australian seafood versus imported seafood is shown in Table 2 below.

Table 2

Proportion of consistent samples in Australian seafood vs. imported seafood

Country of Origin	**Proportion consistent (%)**
Australia	91.74
Imported	97.4

The proportion of total heavy metal and antibiotic residue compliance in the FSC food categories is shown in Table 3 below.

Table 3

Proportion of consistent samples in each seafood category

Category	**Proportion consistent (%)**
Fish	93.3
Crustaceans	100
Mollusc	98.1

Labelling Results

Of the 301 samples assessed there was found to be 60 labelling inconsistencies. Of these 60 inconsistencies 71.67% were due to the lack of an allergen warning and 18.33% due to Nutrition Information Panel inconsistencies.

Discussion

CSP20 Antimicrobial and Heavy Metal Residues found there to be a very high degree of compliance in both Australian and imported seafood to the FSC. No significant differences were observed between imported or Australian seafood in either antimicrobial residues or heavy metal testing. There was only one sample found to contain antimicrobial residues in the 301 samples submitted representing a very high level of compliance to the FSC.

For heavy metal residues, 11 samples contained mercury and 2 samples contained inorganic arsenic above the required standard. The major contributor to these samples was swordfish with 9 of the 13 inconsistencies for heavy metal residues due to swordfish. However as these inconsistencies represent 0.86% of the tests applied for heavy metal residues, there is low risk of harm for consumers. In management of this risk, a review of heavy metals in marine fish meat and consumer health (Bosch, O'Neill, Sigge, Kerwath, & Hoffman, 2015) suggested that rather than limiting fish intake, a focus should be made on determining which fish are safe to consume, with predatory fish consumed in smaller quantities.

Finally, this CSP found 60 labelling inconsistencies in the 301 samples assessed. 71.6% of these inconsistences were due to the absence of an allergen warning. This is of concern for consumers with allergies or intolerances to seafood who wish to avoid these products. LGA's of inconsistent products were informed and appropriate follow up action taken.

The results of this CSP coincide with the high degree of consistency found in the National Residue Survey (ADAWR, 2017) and suggest a similarly high degree of compliance in imported seafood products. This is a re-assuring result for consumers and indicates that heavy metal or antimicrobial residues are not present at the consumer end of the supply chain and hence any pathogenic bacterial resistance may be being acquired further upstream.

Strengths and Limitations

The sample size submitted for analysis in this CSP can be considered relatively large and diverse due to the large range of outlets or manufacturers from which samples were taken. Sampling methods could have included a greater degree of randomization in the selection of manufacturers and vendors, and the goods selected for analysis. Agrifood and ChemCentre conducted analysis with NATA accredited methods which are not discussed in this report, for further information see Appendix B.

Conclusion

With the cooperation of LGA's CSP20 successfully provided a cross section of the current state of heavy metal and antimicrobial residues in Australian and imported seafood in Western Australia. There was found to be a very high degree of consistency across heavy metal residues, antimicrobial residues, products types and across imported and Australian seafood products. This is a reassuring result for consumers in the compliance of seafood products with the FSC. All LGA's with inconsistent products were informed and appropriate action taken to ensure compliance of products to the FSC.

Suggested action on non-complying products

To help to ensure consistent follow-up action on non-complying products the following actions are recommended:

1. Inform the retail outlet in writing that the relevant product does not comply with the Code.
2. When the manufacturer is based in WA, write to the manufacturer and the Local Government Authority in which the manufacturer is located.
3. In situations where the product is not manufactured in WA, the details of the non-compliance should be sent to the Department of Health who will pass the information to the correct enforcement agency in the State or Territory in which the manufacturer is located under the Home Jurisdiction Rule. A copy of the sample submission sheet and the results of analysis should be submitted to the Department of Health Food Unit with a description and details of the non-compliance.
4. Enforcement action can be initiated by a Local Government if the agency is not satisfied with the actions taken by the retailer and/or manufacturer for a product that does not comply with the Code. Where only the retail outlet is within the local government's area, this enforcement action can only be taken for sale of product that does not comply with the Code.

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Appendix A

Number of samples submitted by participating LGAs

Armadale	11
Augusta Margaret River	7
Bayswater	9
Belmont	15
Bunbury	4
Cambridge	3
Canning	10
Capel	14
Claremont	13
Cockburn	6
East Fremantle	4
Esperance	4
Fremantle	12
Gosnells	10
Harvey	17
Joondalup	26
Karratha	7
Kwinana	6
Mandurah	4
Manjimup	3
Melville	12
Mundaring	8
Murray	7
Nannup	2
Rockingham	23
Serpentine Jarrahdale	9
South Perth	12
Stirling	12
Swan	10
Victoria Park	10
Vincent	7
Wanneroo	4
TOTAL	**301**

Appendix B

Raw Data

For further questions or inquiries about raw data contact LHAAC Coordinator Trevor Chapman:

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