LHAAC
LOCAL HEALTH AUTHORITIES ANALYTICAL COMMITTEE

COORDINATED SAMPLING PROJECT 17 – Food Colouring II

Conducted February to May 2016 with Local Governments across Western Australia

December 2017

Local Health Authorities Analytical Committee

Edith Cowan University
Building 19, 270 Joondalup Drive

Joondalup WA 6027

Executive Summary

The purpose of this report is to summarize and discuss the findings from the Coordinated Sampling Project 17 – Food Colouring II, conducted by the Local Health Authorities Analytical Committee. This project was conducted as a follow up to Coordinated Sampling Project 3 – Food Colouring I, as this report found a large volume of food colours in use throughout Western Australia. This report is also intended to address the public concern as to the use of colouring additives in food.

Food samples were submitted by Local Government Authorities from across Western Australia and analysed for the presence of food colours. These samples were then assessed for conformance with the Food Standards Code against any Nutrition Information Panels and labels provided. This CSP found 29.9% inconsistency with the Food Standards Code, indicating that whilst the majority of manufactures are conforming, there are a significant portion of inconsistent products available to the public. Whilst food colours have been determined not to pose a significant health risk (FSANZ, 2008), consumers should be re-assured that the information on food labels is a reliable reference should these additives need to be excluded from the diet. Furthermore, this project finds that there is a decrease in overall use of food colours and an increase in adherence to the Food Standards Code in comparison to the initial Coordinated Sampling Project - Food Colouring I.

This report recommends that Local Governments follow up any non-complying products by contacting the retail outlet, manufacturer or importer of the product and informing them of the non-compliance. Enforcement action can then be initiated by the Local Government if the agency is not satisfied with the actions taken by the retailer, manufacturer or importer.

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

Food additives such as colourings are added regularly to food to enhance flavour, attractiveness and other properties of food and beverages (FSANZ, 2008). The role that food colourings play in our health has been a controversial topic for many years due to the conflicting studies conducted on this matter. Further research and a consensus on advised actions is required.

One of the primary concerns is the relationship between artificial food colourings (AFC's) and hyperactivity in children. There has been shown to be a small but significant relationship between AFC consumption and hyperactivity, however there is a degree of variance between individuals, possibly due to genetic factors or bias in the studies conducted. More research is needed to fully define this relationship (Arnold, Lofthouse, & Hurt, 2012).

An additional concern is the relationship between AFC's and allergies. Some food additives can cause hives and symptoms of asthma. Sensitive individuals are recommended to remove AFC's from their diet as those suffering from chronic hives or swelling are at increased risk of an allergic reaction to certain food colours (Stevens et al., 2013). However once again there is no scientific consensus and further research is still needed.

Introduction

This report aims to present and discuss the findings from the LHAAC CSP No. 17 Food Colouring II. This project aimed to test food products within a range of Western Australian (WA) municipalities as to whether or not they comply with the current FSC. The products were assessed as to their compliance with labelling per the FSC Standard 1.2. The products were also tested for their compliance with Standard 1.3 regarding additives, with samples identified as inconsistent presented and compared to CSP 3 – Food Colouring I. Recommended actions are then discussed for both LGA's and Western Australian citizens.

This report is intended for use by local government agencies throughout Western Australia to ensure compliance with the FSC and to inform policy decision making. Local citizens may also become informed as to how local governments are ensuring the safety of foods in Western Australia and to learn how local governments respond to the habits and trends of consumers in pursuit of high quality, safe produce being available to all Western Australian's.

FSC Standard 1.2 outlines labelling and other information requirements. This project focused on the Standard 1.2.4 in regards to the statement of ingredients displayed on the Nutrition Information Panel (NIP).

FSC Standard 1.3 outlines requirements regarding substances added to or present in food. This project focuses on Standard 1.3.1 which states that the level of food colour additives are to have a combined maximum level of 290mg/kg in processed foods and a combined maximum level of 70mg/L in beverages.

Furthermore, Schedules 1, 3 and 4 were used in informing the analysis in this CSP. Schedule 1 outlines Recommended Dietary Intakes (RDI's) as well as Estimated Safe and Adequate Daily Dietary Intakes (ESADDI's). Schedule 3 details specifications regarding the identity and purity of foods, and schedule 4 outlines guidelines for Nutrition, health and other related claims (FSANZ, 2016).

Sampling and Testing Methodology

From February 1st through April 22nd 2016, minimum 200mL samples were collected by LGA's based upon the population size (see Table 1) and the product type assigned to each LGA (see Appendix A). It was also recommended to any host LGA of WA food manufacturers that distribute outside of the LGA locality to collect samples from that manufacturer, in an effort to avoid duplication of samples and to maximize inclusion of products that are available throughout WA.

Table 1
Number of Samples collected per population of LGA

Population of LGA	**# of samples**
<2000	0 - 2
2001 - 5000	0 - 3
5001 - 20 000	0 - 5
20 001 - 50 000	0 - 8
>50 000	0 - 10

LGAs were instructed as follows:

- Collect the indicated number of samples from food outlets in your locality with a minimum sample size of 200g for food products and 200mL for beverage products.
- Submit the samples to Agrifood or ChemCentre.
- Review the results once received from Agrifood and ChemCentre as provided in this report.
- Participate in follow-up actions for non-complying products.

Lead LGAs were also allocated in order to assign product groups for testing (Appendix A). The type of products included were pre-prepared/processed meals, cereal produce, jams conserves, jellies and toppings, soft drinks, fruit drinks, alcoholic drinks, cordials, dairy, sauces/marinades, confectionary. These categories were further simplified in order to analyse the samples.

LGAs were requested to collect samples from outlets that prepare their own food. Conditions for inclusion were that any product containing food colourings would be tested for conformance with labelling information and products without NIP data would still be tested for the presence and identification of food colourings. Excluded samples included any that fell outside of the product group assigned to each lead LGA.

Protocol 1

All 231 samples submitted were tested with this protocol; any product found to be containing artificial food colourings was tested for conformance with labelling standards. Products without food labels were also tested for the presence of food colourings and those colourings identified if present. 179 of the samples were processed using Liquid Chromatography/ Mass Spectrometry (LCMS), whilst the remaining 52 samples were processed using high pressure liquid chromatography (HPLC).

Protocol 2

The 52 samples tested using High Performance Liquid Chromatography (HPLC) were also analysed for volume of food colour additives and selected banned food colour additives. Colours permitted were assessed against the standard of containing a combined maximum level of 290 mg/kg in processed foods and a combined maximum level of 70 mg/L in beverages.

Methods of testing and analysis

Liquid chromatography provides separation of mixtures with multiple components, whilst mass spectrometry provides a structural identification of those components with a high degree of detection and sensitivity. HPLC is used to separate, identify and quantify the components in a mixture. The data provided from these two testing methods was then assessed against any available food labels for compliance and compared qualitatively against CSP 3 – Food Colours I (Gutierrez et al., 2010).

179 samples were tested for Tartrazine, Sunset Yellow, Azorubine, Ponceau, Allura Red, Brilliant Blue and Brilliant Black. The remaining 52 samples were tested for all of the above as well as Amaranth, Annatto, Erythrosine, Cochineal and Carmines, Quinoline Yellow, Carmiosine, Indigotine, Fast Green, Green S and Brown HT. Results were excluded from analysis if colours were declared but not tested for in this analysis.

Results

Two hundred and thirty-one samples were collected by the end of April 2016 as shown in Table 2 below.

Table 2

Number of samples per product category

Product Type	# for Protocol 1	# for Protocol 2
Cake/ Biscuits	33	10
Confectionary products	5	0
Drink products	52	30
Condiments	54	0
Meat/ Burgers	5	0
Ready to Eat Meals (RTEM)	25	9
Cheese/ Diary	14	0
Other	43	3

Protocol 1

The principal findings of this CSP for the 231 samples tested for food colour presence, type and NIP information disclosure, is that 88 of the samples tested positive for various food colours as seen in *Figure* 1 below.

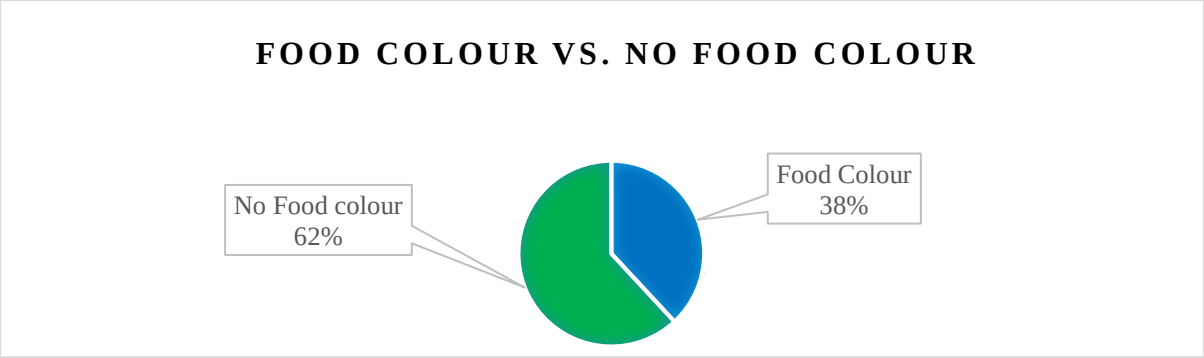

Figure 1: Proportion of samples tested that contain food colour vs. samples that did not.

Of the samples that provided label information 29.9% were inconsistent between colourings found to be present in the food and colourings identified on the label as shown in *Figure* 2 below. Meaning that the majority of samples were consistent in conforming to the FSC.

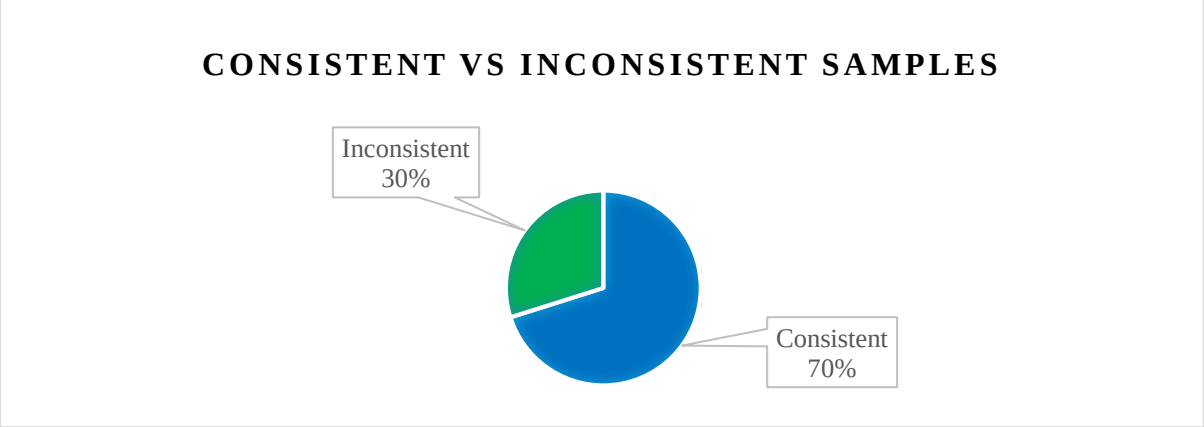

Figure 2: Proportion of consistent to inconsistent samples as per the FSC.

Nine samples stated on their label the presence of colours that were not found to be in the samples as determined by the testing conducted. There was fifty nine cases of a product failing to provide on their NIP the presence of an artificial colouring when that colouring was in fact present or the presence of a colour without any NIP label, and 1 sample transgressing both cases. This is represented in *Figure 3* below.

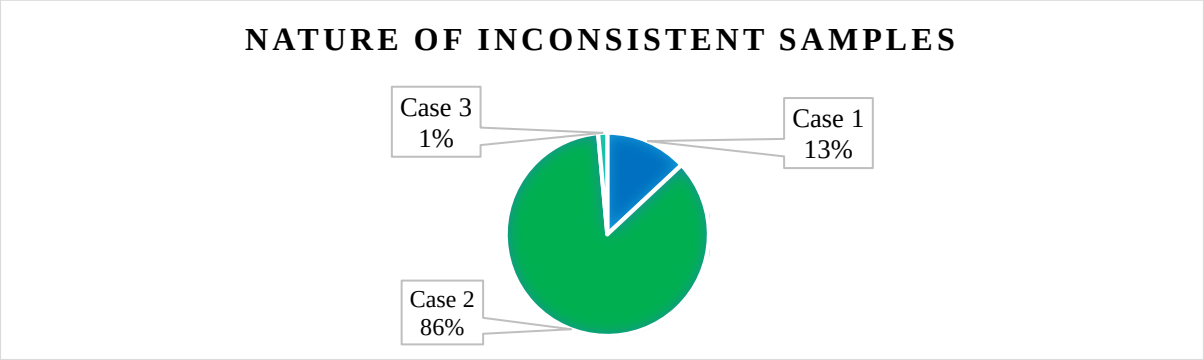

Figure 3: Case 1 - declared food colour not present in sample. Case 2 - sample contains an undeclared food colour. Case 3 - describes samples that contain both Case 1 and 2 inconsistencies.

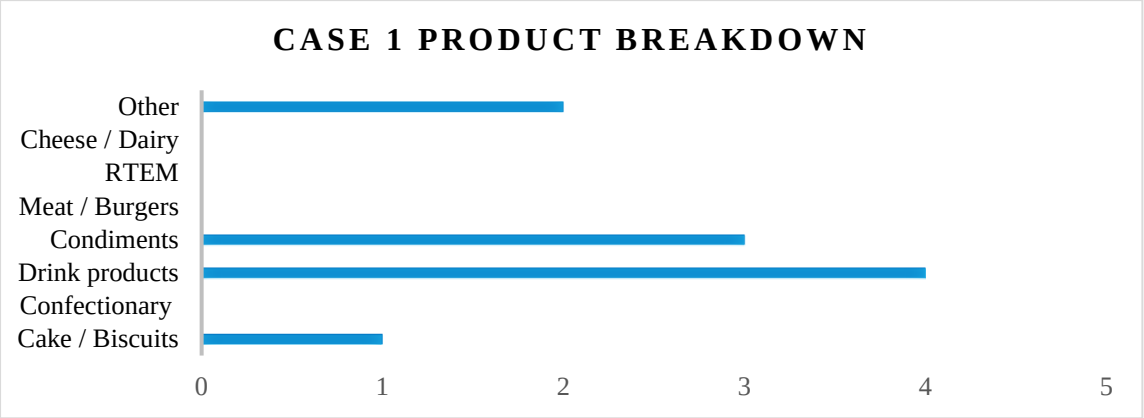

Figure 4: Number of inconsistencies for each product category contributed to Case 1.

As seen in the above *Figure 4*, drink products followed by condiments were the most inconsistent product found to have colours listed on their label but not to be found in the actual product as determined by this project's testing.

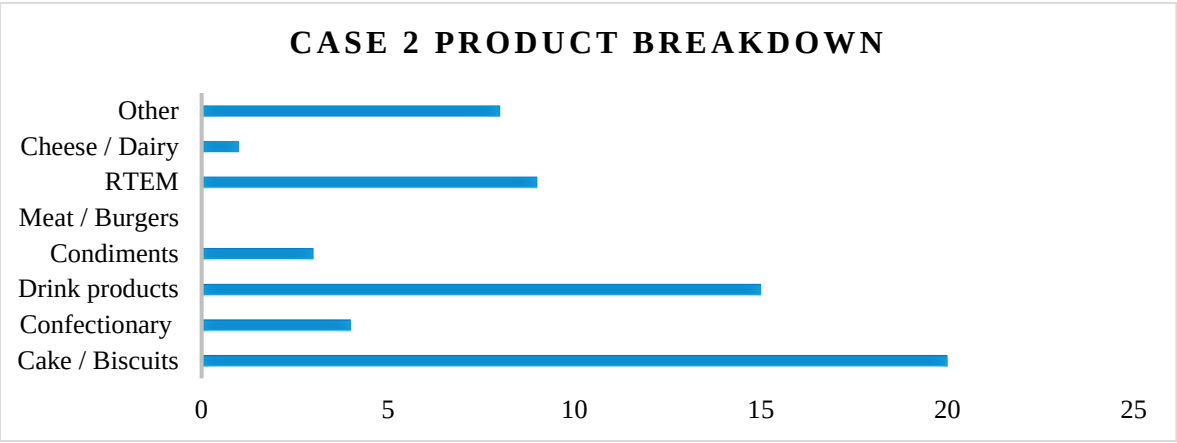

Figure 5: Number of inconsistencies for each product category contributed to Case 2.

The above *Figure 5* shows that cake and biscuit products followed by drinks were the most inconsistent in containing food colours that were not disclosed by the label. Only one sample was found to be inconsistent on both cases (i.e. Case 3).

Protocol 2

For the 52 samples analysed for volume of colours added and the presence of banned substances, two were found to be non-compliant with the total allowable level of colour additives. One sample was found to contain a banned Schedule 1 food additive. Annatto extracts are limited to 10mg/kg of product as per schedule 1 of the FSC; this sample was found to exceed this limit. The two samples found to be in excess of the 70mg/L of food colour additives for beverages/drinks were found with a total volume of 181.5mg/L and 2147.4mg/L (1.d.p) of food colours.

The results for both protocols have been compared to those from the previous CSP on food colourings conducted in 2010. This previous report found a high degree of both natural and artificial colourings in food products throughout Western Australia. Of products sampled that also provided NIP panels, 42% were found to be inconsistent as they contained food colourings that were not disclosed on the NIP.

Discussion

Protocol 1

The findings of this CSP indicate that the public should be re-assured as to the adherence of manufacturers to the FSC. Whilst this report found there to be a degree of inaccuracy in regards to the label's information regarding the presence or absence of food colours (29.9% showed to be inconsistent in this sample) this is an improvement compared to the previous CSP and is in support of the surveys conducted by FSANZ in 2008 and subsequently in 2012. This is important for any consumers who wish to avoid certain colours, as they must rely on the information provided on food labels in order to do so. It is noteworthy that some samples that were found to have inconsistent food labels were stating natural colours on their labels whilst in fact using artificial colours. Of particular concern is the samples containing undeclared food colours. This represents an area for follow up and possible intervention by local governments particularly with Cakes, Biscuits and Drinks (see *Figure 5)*, to ensure the public can make informed decisions as to their food choices.

Protocol 2

The findings of this CSP indicate that the public may also be re-assured the FSC is being adhered to in regards to the volume of food colours present in foods with a high degree of consistency found in this CSP. Of some concern is the presence of a banned food additive found in a single sample, however as this represents less than 2% of the total products sampled this is a low level of inconsistency and appropriate follow up action at the individual level has been advised.

Of the product categories selected it is noteworthy that ready to eat meals, meat and burger products as well as cheese and dairy were found to have no or very few colours present.

These results represent a significant change from CSP 3 – Food Colourings. There is a clear decrease in both the overall food colours added to the foods throughout Western Australia as well as a decrease in the number of inconsistent samples found amongst these products.

These results are re-assuring for the public as it is clear that the large majority of food manufacturers in Western Australia are complying with the FSC. However, the nature of the small number of discrepancies found also imply that continued vigilance is required in order to ensure the continuation of this compliance.

Strengths and Limitations

A number of factors contributed to the limitations of this sampling project. Sampling methods could have included a greater degree of randomization in the selection of manufacturers and vendors, and the goods selected for analysis. Reasonable limitations were placed on sample size and manufacturers from each municipality were targeted to reduce the possibility of duplication of samples. The sample size collected was small in comparison to the range of products available and the distribution of samples in product categories was uneven. This reduces the rigour of the results as other food categories may have shown differing results if their portion of the sample had been increased.

The results could also have benefited from detail in relation to sample collection, as testing only confirmed presence or absence of the criteria and conforming to the FSC and not specific volumes for protocol 1. This would have provided a more in-depth analysis of the relationship between food category and food colour volumes. A deeper analysis of natural versus artificial food colours would also have improved the quality of analysis on this data.

Furthermore, there was no screening by LHAAC for samples that were exempt from NIP labelling. A further possible source of inaccuracy was the methods of testing. HPLC and LCMS both identify and quantify the substances involved however, they differ in specificity and accuracy (Scotter, 2009). Future projects in this arena should focus on consistent and reliable testing methodologies and stratification of data for more comprehensive analysis that will lead to conclusions that are more robust.

The greatest strengths of this project were the wide variety of samples tested and the distribution of samples collected throughout Western Australia which increase the applicability of this projects results for the public.

Conclusion

These results strongly support the results found by the earlier survey conducted by FSANZ in 2008. Added food colours are not a significant risk to public health (FSANZ, 2008) however, it is still of paramount importance that the FSC is adhered to in order for consumers to be empowered to make informed decisions should they choose to exclude these additives from their diet. The relevant LGAs were informed of inconsistent samples and appropriate action taken to ensure the future compliance of imported food products in WA to the FSC. Whilst this project did find a significant number of inconsistent samples, in consideration of the nature of those inconsistencies and the limitations of this project, there is still a clear improvement of adherence to the code from the previous CSP by manufacturers throughout Western Australia.

Suggested action on non-complying products

1. Inform the retail outlet in writing that the relevant product does not comply with the Code.
2. If the manufacturer or importer is based in WA, write to the manufacturer or importer and the LGA in which the manufacturer is located.
3. Where the manufacturer or importer is not located 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/ importer 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, manufacturer or importer located in their area in relation to a product that does not comply with the Code. If the manufacturer or importer is outside the Local Government's area, the Local Government may still take action against a retailer but only for the sale of a product that does not comply with the Code.

References

Arnold, L., Lofthouse, N., & Hurt, E. (2012). Artificial Food Colors and Attention-Deficit/Hyperactivity Symptoms: Conclusions to Dye for. *Neurotherapeutics*, *9*(3), 599-609. http://dx.doi.org/10.1007/s13311-012-0133-x

Colourful Cupcakes. (2017). Retrieved from http://drop.ndtv.com/albums/COOKS/happy-holi/colourful-food_pg.jpg

FSANZ,. (2008). Survey of Added Colours in Foods Available in Australia.

FSANZ,. (2012). *Supplementary report to the 2008 Survey of added colours in foods available in Australia*.

FSANZ,. (2016). *Food Standards Code*.

Scotter, M. (2009). The chemistry and analysis of annatto food colouring: a review. *Food Additives & Contaminants: Part A*, *26*(8), 1123-1145. http://dx.doi.org/10.1080/02652030902942873

Stevens, L., Kuczek, T., Burgess, J., Stochelski, M., Arnold, L., & Galland, L. (2013). Mechanisms of behavioral, atopic, and other reactions to artificial food colors in children. *Nutrition Reviews*, *71*(5), 268-281. http://dx.doi.org/10.1111/nure.12023

Appendix A

Sampling Instruction Tables

Number of samples collected by each LGA

Council	# of samples
Albany	8
Augusta	5
Bunbury	5
Busselton	8
Cambridge	8
Canning	11
Capel	7
Claremont	5
Cockburn	12
Derby/ West Kimberley	3
East Fremantle	5
Garrahdale	8
Gosnells	2
Harvey	8
Joondalup	10
Kalamunda	10
Kalgoorlie	8
Karratha	5
Kwinana	7
Mandurah	7
Manjimup	7
Melville	10
Mosman Park	5
Murray	5
Nannup	2
Nedlands	16
Rockingham	6
Stirling	10
Swan	10
Victoria Park	8
Wanneroo	10
Total	231

Product Groups Assigned to each Lead LGA

PRODUCT GROUP TO TEST	LOCAL GOVERNMENT AUTHORITIES TO COLLECT SAMPLES	
	LEAD LGA	**OTHER LGA's**
SOFT DRINKS, FRUIT DRINKS, ALCOHOLIC DRINKS, CORDIALS	City of Canning	Bassendean, Bayswater, Belmont, Beverley, Boddington, Boyup Brook, Bridgetown-Greenbushes, Brookton, Broome, Broomehill-Tambellup, Bruce Rock, Bunbury, Chittering, Claremont, Collie, Coolgardie, Coorow, Corrigin, Cottesloe, Halls Creek, Harvey, Mingenew
JAMS, CONSERVES, JELLIES, TOPPINGS	City of Stirling	Dalwallinu, Dandaragan, Dardanup, Denmark, Derby-West Kimberley, Donnybrook-Balingup, Dowerin, Dumbleyung, Dundas, East Fremantle, East Pilbara, Esperance, Exmouth, Fremantle, Gingin, Gnowangerup, Goomalling, Moora, Morawa, Mosman Park.
CEREAL PRODUCTS	City of Joondalup	Albany, Armadale, Ashburton, Augusta-Margaret River, Irwin, Jerramungup, Kalamunda, Kalgoorlie-Boulder, Katanning, Kellerberrin, Kent, Kojonup, Kondinin, Koorda, Kulin, Kwinana, Lake Grace, Laverton, Leonora, Mt Magnet, Mt Marshall, Mukinbudin.
PRE-PREPARED/PROCESSED MEALS	City of Melville	Busselton, Cambridge, Capel, Carnamah, Carnarvon, Greater Geraldton, Karratha, Mundaring, Murchison, Murray, Nannup, Narembeen, Narrogin (s), Nedlands, Ngaanyatjarraku, Northam, Northampton, Nungarin, Port Hedland, Shark Bay, Subiaco, Tammin.
DAIRY (incl cheese, milk, ice cream, yoghurts)	City of Perth	Chapman-Valley, Narrogin (T), Peppermint Grove, Perenjori, Pingelly, Plantagenet, Quairading, Ravensthorpe, Rockingham, Sandstone, Serpentine-Jarrahdale, South Perth, Three Springs,
SAUCES/MARINADES	City of Swan	Cranbrook, Cuballing, Cue, Cunderdin, Victoria Park, Victoria Plains, Vincent, Wagin, Wandering, Waroona, West Arthur, Westonia, Wickepin, Williams, Wiluna, Toodyay, Trayning.
CONFECTIONARY (Biscuits, Cakes, Snack Bars etc.)	City of Cockburn	Mandurah, Manjimup, Meekatharra, Menzies, Merredin, Upper Gascoyne, Wongan-Ballidu, Woodanilling, Wyalkatchem, Wyndham/East Kimberley, Wanneroo, Yalgoo, Yilgarn, York.

Appendix B

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

Local Health Authorities Analytical Committee
Edith Cowan University
Building 19, 270 Joondalup Drive
JOONDALUP WA 6027

Email: t.chapman@ecu.edu.au
Phone: 08 6304 2104