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CITY OF SYDNEY

Processing and safety of raw egg dressings in cafés and restaurants in Sydney

A survey on the handling and microbiological quality of raw egg dressings prepared and sold in cafés and restaurants in City of Sydney LGA

Food Regulation Partnership™

A report for the Food Regulation Partnership as part of a Special Projects Grant awarded to the City of Sydney Local Government Area

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Executive summary

Raw egg dressings are often used in the restaurant and café sector. The use of raw egg dressings is a major food safety concern and large outbreaks involving these dressings continue to occur. A recent NSW outbreak from contaminated raw egg aioli which occurred in mid 2010 involved 179 cases.

This project aimed to:

- Highlight the risks of raw egg dressings and provide education and information about safer alternatives to businesses using these products.
- Determine the microbiological quality of raw egg dressings served in restaurants and cafés within the City of Sydney Local Government Area (LGA).
- Review the current food handling practices used in the restaurant and café sector in relation to the production and handling of raw egg dressings including hand washing mid way through the preparation of raw egg dressings (both before and after separating eggs).
- Review food handler's knowledge on egg safety and quality.

In total 107 samples of raw egg products were taken from 46 premises:

- Thirteen samples were classified unsatisfactory due to high standard plate counts and/or moderate levels of *Bacillus cereus*.
- One sample of Caesar dressing was classified potentially hazardous due to a high level of *B. cereus* (31,000 cfu/g).
- *Salmonella* was not detected in any samples tested.

Information on food handling, product preparation, cleaning and sanitation and egg quality was obtained from 44 premises via on-site observation and questionnaire:

- 10% of sauces were stored at ambient temperatures.
- 71% of samples had a temperature greater than 5°C (and less than 60°C). Constant moving in and out of refrigeration may be responsible for an elevated product temperature.
- 74% of products sampled were not date coded and 41% of products did not have a known shelf life policy at the time of inspection.
- The majority of premises who separated eggs did so by hand; four used gloved hands and 24 used bare hands. Six premises separated eggs using the shells. In general hand washing after handling eggs was not considered as important as washing hands after handling raw chicken or meat.
- 23% of premises had cracked or dirty eggs in storage and there seemed to be a distinct lack of knowledge regarding the quality of the egg, the risks associated with using cracked and dirty eggs, and the egg supplier.
- Only 52% of the food businesses stored whole eggs under 5°C.

The majority of businesses surveyed required improvement in:

- temperature control of raw egg products during and in between use.
- date coding of raw egg products.
- egg separation technique during processing to prevent cross contamination.

The project was funded in part by a grant obtained by the City of Sydney from the Food Regulation Partnerships (FRP) Special Projects Grant and the NSW Food Authority. Officer resources were funded by City of Sydney who carried out data collection and product sampling.

Introduction

The City of Sydney LGA is home to some 4000 food premises offering a wide range of cuisines from across the world. Inspectors have noted a high number of premises making their own raw egg dressings without a further cooking process. Raw egg dressings are classified as a potentially hazardous food.

Potentially hazardous foods

Potentially Hazardous Food[1] (PHF) must be displayed and stored in a manner that minimises the growth of pathogenic bacteria and bacteria that can form toxins in food. Temperature control is the simplest and most effective way of controlling the growth of bacteria. The Food Standards Code requirements (Table 1) for the storage and display of potentially hazardous foods are:

- PHF must be stored and displayed below 5°C or above 60°C, or as an alternative
- if stored or displayed at temperatures between 5° and 60°C more than four hours, PHF must be thrown out, or
- if stored or displayed between 5° and 60°C for between two and four hours, PHF must be used immediately, or
- if stored or displayed at between 5° and 60°C for less than two hours, PHF may be either refrigerated or used immediately.

Food businesses can change these requirements if they can demonstrate that some other practice will minimise the growth of pathogenic bacteria and toxin production by bacteria. Scientific expertise and/or laboratory testing is required to demonstrate that any other practice is effective (NSW Food Authority, 2008).

Table 1: Options available under the "4-hour/2-hour rule" (NSW Food Authority, 2011)

Time at 5–60°C		
0–2 hours	2–4 hours	Over 4 hours
Use immediately or return to refrigerator	Discard or use immediately	Discard

[1] The Australia New Zealand Food Standards Code defines potentially hazardous food as *food that has to be kept at certain temperatures to minimise multiplication of any food-poisoning bacteria that may be present in the food or to prevent the formation of toxins in the food*.

Salmonella

Salmonellosis is one of the leading causes of food poisoning in Australia with almost 12,000 cases reported in 2010 (Australian Government Department of Health and Ageing, 2011). It is estimated that food poisoning costs Australia more than $1.2 billion each year (Australian Government Department of Health and Ageing, 2006). Symptoms of *Salmonella* poisoning include diarrhoea and vomiting; usually lasting 4 to 7 days. Onset is usually 6 to 72 hours after eating contaminated food. Daughtry et al. (2005) concluded that the prevalence of internal contamination by *Salmonella* in Australian eggs is likely to be close to the overseas reported rate of 0.004%, roughly equivalent to one egg every 25,000 being contaminated with *Salmonella*. This prevalence must be considered in the context that there are over 800 million eggs consumed in NSW each year, both as shell eggs and as an ingredient in food. At this prevalence, there may be 32,000 eggs contaminated with *Salmonella* consumed each year in NSW (NSW Food Authority, 2009a), some of which may be used in making raw egg dressings.

Salmonella can naturally be found in the intestinal tract of chickens. Eggs can become contaminated with *Salmonella* during or after laying through contact with contaminated faecal material (Humphrey, 1994). The shells of eggs are porous, which may allow bacteria to pass through the shell into the contents. Cracked shells, including fine hairline cracks that are invisible to the naked eye, reduce the natural protection of the egg and increase the egg's susceptibility to contamination.

In Australia, the majority of eggs undergo 'candling' — a process that detects fine cracks in eggs — before sale. However, eggs can develop cracks and hairline cracks after this process, resulting in an increased chance of contamination.

Luber (2009), reviewed global published data on the prevalence of *Salmonella* on the surface and inside shell eggs and concluded that surface prevalence ranged from 0.04% to 9.0%. Only half of the studies reviewed by Luber detected contamination in the contents of the egg. A study conducted in Ireland developed a predictive model that determined there is a 90% chance that between 0.0043% and 0.038% of food containing eggs produced in Ireland will be contaminated with *Salmonella* spp (Kelly, Murchie, Xia, Whyte & Madden, 2009). The Food Standards Agency UK found a *Salmonella* prevalence of 0.38% on egg shells (Food Standards Agency, n.d.). Another study conducted in the UK involved 1744 eggs from non-UK origins and found 163 samples contained *Salmonella* on the shell and ten samples in the contents (Pugh, 2006). It must be noted that, in Europe and other countries, a type of *Salmonella*, *S.* Enteritidis, has caused public health issues due to its ability to infect the layer hen and contaminate the internal contents of eggs prior to shell formation. The Australian egg laying flock is generally free of *S.* Enteritidis and therefore in Australia, if contamination of eggs with *Salmonella* does occurs it is normally on the outside of the shell.

Raw egg dressings

Raw egg dressings and sauces such as mayonnaise, Caesar and tartare dressing are widely used in the restaurant and café sector. They are often made in large batches and kept in service refrigerators which are opened and closed regularly during busy periods, compromising temperature control. Sauce dispensers are more often than not left out on a work surface during use for convenience, and regularly moved in and out of the refrigerator over a period of up to and over a week, resulting in repeated temperature abuse.

Many businesses have poor procedures for cleaning and sanitising equipment. Sauce bottles (and their nozzles and lids) and whisks are often awkward in shape and therefore difficult to clean. Poor sanitation and cleaning of equipment can increase the risk of an outbreak occurring via cross contamination.

In addition, many cafés prepare hollandaise sauce (which is typically served warm) in bulk, early in the morning, and leave it at room temperature during service, the time of which can vary. Many store it adjacent to cooking equipment to keep it warm.

There have been a number of foodborne illness outbreaks implicating raw egg products as the vehicle of infection (Table 2), resulting in some cases requiring hospitalisation.

As of October 2010 there were three businesses listed on the Authority's name and shame website for poor practises resulting in the serving of raw egg dressings contaminated with *Salmonella* (tartare sauce, raw egg butter and raw egg aioli). The raw egg aioli outbreak involved a large number of cases and a summary is presented in Box 1. The largest recent outbreak in NSW (over 300 cases) involved *Salmonella*-contaminated raw egg mayonnaise used in Vietnamese pork rolls as the vehicle of infection. A summary of this outbreak is presented in Box 2.

There appears to be little awareness amongst food business operators about prevention of cross contamination from *Salmonella* on the egg surface to the final product.

To date, raw egg sauces and dressings, such as mayonnaise, hollandaise and tartare sauce, prepared and used onsite in the restaurant sector in NSW, have not been surveyed for microbiological quality and safety.

Table 2: Outbreaks in Australia involving raw egg products as the vehicle of infection

Year	State	Vehicle	Number of cases	Number hospitalised	Setting	Reference
2002	NSW	egg based dressing	17		restaurant	OzFoodNet, 2003
	NSW	deep fried ice cream (using raw egg batter)	8		restaurant	
2003	QLD	suspected raw egg sauces	18	3	restaurant	OzFoodNet, 2004
	VIC	raw egg dishes	52	4	restaurant	
2004	VIC	suspected raw egg sauce	8	1	café	OzFoodNet, 2005
2005	VIC	milkshake with raw egg	4	4	private residence	OzFoodNet, 2006
	TAS	bakery products	107	6	bakery	
2007	NSW	raw egg mayonnaise	319	125	bakery	OzFoodNet, 2008
	VIC	pork rolls with egg mayonnaise	45	-	bakery	
	VIC	chicken foccacia with raw egg dressing	16	-	restaurant	
	NSW	suspect raw egg mayonnaise	15	-	bakery	
	NSW	cake with raw egg	27	-	bakery	
	VIC	Caesar salad dressing with raw egg	15	-	restaurant	
2008	ACT	hollandaise sauce and poached eggs	24	2	restaurant	OzFoodNet, 2009
	NSW	raw egg aioli	5	-	restaurant	
	NSW	raw egg Caesar dressing	24	1	restaurant	
	TAS	Aioli	78	9	restaurant	
	NSW	chocolate mousse	10	-	aged care	
2009	NSW	hollandaise sauce	40	5	institution	OzFoodNet, 2010a
	NSW	raw egg mayonnaise	68	14	private residence	
	NSW	fried ice cream	33	13	restaurant	
	NSW	raw egg sauces	8	2	mobile fair	

Year	State	Vehicle	Number of cases	Number hospitalised	Setting	Reference
	NSW	pork rolls (using raw egg mayonnaise)	10	3	bakery	
	SA	aioli	8	-	caterer	
	WA	Vietnamese pork roll	31	9	takeaway	
	WA	raw egg mayonnaise	39	6	restaurant	
2010	NSW	aioli	170		burger bar	NSW Food Authority, 2010
	WA	aioli and Caesar dressing	25	5	restaurant	OzFoodNet, 2010b

Box 1: Case study: *Salmonella* outbreak from contaminated aioli served in a burger bar (NSW Food Authority, 2010)

In early 2010 the Authority investigated an outbreak of food poisoning linked to a popular burger bar in NSW. The initial notification from NSW Health was that twenty people who had eaten from the burger bar on one weekend had suffered gastroenteritis. Within two weeks the number of people affected by the outbreak had risen to 179, with the bacterium *Salmonella* responsible. Investigations revealed that:

- the burger bar was using aioli made from raw eggs which did not receive any further cooking or processing
- *Salmonella* was present in samples of aioli taken from the burger bar
- the aioli had a pH of 5.8 which would not prevent the growth of any *Salmonella* present, particularly at high ambient temperatures
- the outbreak occurred during the summer when ambient temperatures at the burger bar were high (>30°C)
- *Salmonella* was also present in a swab from a chopping board indicating poor controls over cross contamination and inadequate sanitising of equipment and surfaces
- the burger bar was sourcing eggs from a local hobby farm rather than a dedicated egg supplier. The hobby farm did not have any system for quality control, such as candling or crack detection, and eggs were not washed prior to sale. Eggs were also placed into reused cartons which increased the potential for cross contamination of *Salmonella* to the outside of shells
- the eggs were not stored in a refrigerated environment

All these factors combined to contribute to this outbreak.

Box 2: Case study: *Salmonella* outbreak from contaminated raw egg mayonnaise served in a bakery (Mannes, et al, 2010)

In 2007, the Authority investigated a large outbreak of *Salmonella* linked to a bakery in Sydney. Initially NSW Health reported five people suffering acute gastroenteritis who had eaten from the same bakery. By the end of this outbreak investigation this number had risen to 319 confirmed cases. Investigations by the Authority and NSW Health discovered:

- this bakery sold Vietnamese rolls using a raw egg mayonnaise which was made onsite
- approximately 320 pork rolls would generally be sold over a five day period. All confirmed cases consumed food from the bakery over a five day period, indicating an estimated attack rate of 100%
- 125 cases required hospital admission with 76 cases presenting to the one hospital alone (which was located 5km from the bakery). Generally less than 10% of *Salmonella* infections require hospitalisation. The large number of cases that required hospital admission was an indication of the severity of this outbreak
- Five of the 319 confirmed cases were also food handlers at the bakery. An additional asymptomatic food handler from the bakery also had a positive stool sample for *Salmonella*
- *Salmonella* was detected in the raw egg mayonnaise, ham, pork, chicken, pâté and shell eggs sourced from the bakery. Enumeration of the raw egg mayonnaise showed a *Salmonella* count of 1.1×10^7 cfu/mL. This count was extremely high, re-enforcing the observed severity of the illness
- *Salmonella* was also detected in swabs of the preparation bench, tongs, meat slicer, floor drain and display tray, indicating very poor hygiene, poor control of cross contamination and inadequate sanitation which would have contributed to the proliferation of the organism and its spread throughout the premises after the initial contamination

In 2005, well before the outbreak which occurred in early 2007, the bakery was presented with information about the risks of raw egg based foods and also advised to use a commercial, pasteurised mayonnaise by the Authority. This advice was ignored, and as a result of the outbreak, and after ignoring the advice from the Authority in 2005, a large fine was imposed by the courts as a result of prosecution action undertaken by the NSW Food Authority.

The Food Standards Code

Businesses involved in food service are required to adhere to the *Australia New Zealand Food Standards Code* (the Code).

Standard 3.2.2, Division 3 Clause 6 and 7 outline the requirements in regards to storage and food processing in food businesses (eg cafés and restaurants) which in this case relate to the production and service of raw eggs dressings. Standard 2.2.2, Clause 3 of the Code prohibits the sale of cracked eggs for retail sale or for catering purposes.

- Standard 3.2.2, Division 3, Clause 6: Food storage

(1) A food business must, when storing food, store the food in such a way that –

(a) it is protected from the likelihood of contamination, and

(b) the environmental conditions under which it is stored will not adversely affect the safety and suitability of the food.

(2) A food business must, when storing potentially hazardous food –

(a) store it under temperature control, and

(b) if it is food that is intended to be stored frozen, ensure the food remains frozen during storage.

- Standard 3.2.2, Division 3, Clause 7: Food processing

(1) A food business must –

(a) take all practicable measures to process only safe and suitable food; and

(b) when processing food –

(i) take all necessary steps to prevent the likelihood of food being contaminated, and

(ii) where a process step is needed to reduce to safe levels any pathogens that may be present in the food – use a process step that is reasonably known to achieve the microbiological safety of the food.

(2) A food business must, when processing potentially hazardous food that is not undergoing a pathogen control step, ensure that the time the food remains at temperatures that permit the growth of infectious or toxigenic micro-organisms in the food is minimised.

NSW Food Regulation 2010

The NSW Food Regulation 2010 underpins the Authority's and local councils' food regulatory work, which aims to reduce the incidence of foodborne illness linked to certain food sectors in NSW. Part 10 of the regulation relates to the production, processing and sale of eggs. The following clauses specifically relate to the sale of eggs for human consumption:

- Clause 156 – prohibits the sale of unpasteurised egg product[2] and unpasteurised blended egg product mixture[3] unless it is sold to a business that is licensed with the Authority to pasteurise these products
- Clause 157 – prohibits the sale of unpasteurised egg product for use in food for sale
- Clause 158 – prohibits the sale of unpasteurised blended egg product mixture for use in food for sale
- Clause 159 – prohibits the sale of cracked eggs[4] for retail or catering purposes (they may be sold to a licensed egg processor)
- Clause 160 – prohibits the sale of broken eggs[5] for human consumption
- Clause 161 – prohibits the sale of dirty eggs to non licence holders. Dirty eggs must be cleaned before sale for retail and catering purposes.

This means that food service and manufacturing businesses can only purchase and use whole clean eggs or pasteurised egg in the preparation of food, eg raw egg dressings and sauces.

For more information on egg regulation please refer to the NSW Food Authority's website: http://www.foodauthority.nsw.gov.au/industry/industry-sector-requirements/eggs or http://www.foodauthority.nsw.gov.au/industry/food-standards-and-requirements/legislation/foodregulation

[2] **Egg product** is defined as the whole or a part of the content of an egg with the shell removed and in any form.

[3] **Blended egg product mixture** is defined as a product consisting of at least 80 per cent by weight of egg white or yolk, or both, and other food

[4] **Cracked eggs** are eggs with a cracked shell (where a crack is visible by the naked eye or by candling) and an unbroken shell membrane. Hairline cracks often escape visual detection and can worsen as eggs move through the supply chain.

[5] **Broken eggs** are eggs with a cracked shell and a broken shell membrane

Method

Between January and May 2010 officers from The City of Sydney Council (the City) and the Authority collected samples of raw egg dressings and sauces prepared onsite and used in cafés, restaurants and hotels in the local government area. Businesses known to be making raw egg dressing were selected from the City's inspection database[6]. In addition, a proportion of random businesses were selected who had not yet had any contact in relation to the subject. During the visits it was found that some businesses had ceased making raw egg products based on previous inspector's advice; in this instance officers were unable to take samples. The visits were conducted as part of the City's normal risk rated inspection program. Business are categorised by a risk rating system to denote the results of the inspection (Satisfactory, Low Risk, Medium and High Risk).

Any follow up action and enforcement was based on this risk rating and was carried out accordingly, based on severity and premises history. A combination of advice, education and if necessary, enforcement action, was carried out to address any relevant breaches. Education was the main tool for informing of the risks of raw egg dressings and appropriate controls. Primarily businesses were advised to substitute their products to either commercial mayonnaise or pasteurised egg products.

Food handling practices

The inspections formed the major part of the sampling program. During each inspection, a questionnaire was completed to assess the raw egg handling process from start to finish along with food handling practices such as hand washing, cross contamination prevention and sanitising. A copy of this questionnaire can be found in Appendix 1. Any additional observations were also noted.

Microbiological quality of raw egg dressings and sauces

Samples of raw egg dressings and/or sauces were collected during each inspection. Samples were collected in sterile 250ml sample jars using aseptic techniques. Type and number of samples collected depended on what was available at time of sampling. The temperature of each sample at time of sampling was taken using a sterile probe thermometer and recorded. Type of sample, ingredients, process used, storage container and location of sample were also recorded. The samples were placed in an esky with ice bricks and a data logger and transferred to a car refrigerator[7]. Samples were then transported to the Food Microbiology and General Chemistry Laboratory of the Division of Analytical Laboratories at Lidcombe for testing. Samples were tested for *Salmonella*, *Bacillus cereus*, *Escherichia coli*, Standard Plate Count (SPC), pH and water activity. Results were then assessed against the Authority's *Microbiological quality guide for ready-to-eat foods* (NSW Food Authority, 2009b).

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[6] The City's database collects profile information on restaurants and cafés acquired during routine inspections. This includes information on whether retail businesses produce raw egg dressings and sauces

[7] Using the FRP grant money the City purchased a car refrigerator and a data logger to assist with sampling. The Authority provided the rest of the sampling equipment.

Results and discussion

Microbiological analysis

A total of 107 raw egg dressings, sauces, pooled egg mix and desserts were sampled and tested for a range of pathogens and indicator organisms. Results are outlined in Table 3.

Thirteen samples were classified unsatisfactory due to high SPC and/or high levels of *B. cereus*.

One sample of Caesar dressing was classified potentially hazardous due to a high level of *B. cereus* (31,000 cfu/g). Levels of *B. cereus* greater than or equal to 10,000 cfu/g are classified potentially hazardous, because at these levels the organism might begin to produce toxin. Further processing will not destroy this toxin once formed. This sample was stored during service at ambient temperature in a dirty squeeze bottle. The product had no defined shelf life, was not date coded and according to staff at the time of sampling, was made approximately two weeks prior to sampling. The level of *B. cereus* indicated that the product had been subjected to temperature abuse over a period of time.

Table 3: Microbiology results as compared to the Authority's *Microbiological quality guide for ready-to-eat foods* (category B2[1])

Product category	Number	Good	Acceptable	Unsatisfactory	Potentially hazardous
Caesar dressing	26	12	11	2	1
Dessert	5	4	0	1	0
Hollandaise/béarnaise	11	10	1	0	0
Mayonnaise	11	8	1	2	0
Mayonnaise – flavoured	47	35	6	6	0
Pooled egg	7	4	1	2	0
Total	107	73 (68%)	20 (19%)	13 (12%)	1 (1%)

[1] NSW Food Authority (2009b)

The thirteen products classified unsatisfactory were due to:

- *B. cereus* ranging from 2400 to 3700 cfu/g (one plain mayonnaise and three flavoured mayonnaises)
- SPC levels ranging from 1.2 x 10^7 to greater than 2.5 x 10^8 cfu/g (upper limit of detection)
- one sample of flavoured mayonnaise had both high SPC and high *B. cereus* levels

SPC can provide a general indication of the hygiene of a product. However SPC does not differentiate between the natural microflora of a product, spoilage bacteria or pathogenic bacteria. High SPC in these products may indicate poor handling and/or hygiene. The use of ingredients such as salt, pepper and herbs may increase the SPC of the product.

pH

The pH of 69 samples was measured (Table 4). The majority of dressings had a pH under 4.6. All samples of pooled egg and dessert had a pH above 4.6. Acidification is an important control to prevent the growth of pathogens.

None of the businesses sampled were analysing products in order to use pH as a control factor for safety.

Businesses using pH as a control factor in the critical range (ie pH 4 to 5) should have levels confirmed by an accredited laboratory, or monitor and record pH on a regular basis (using test strips or a pH probe).

Table 4: pH results for each sample category

Product category	Number	≤4.2	4.2 ≤4.6	>4.6
Caesar dressing	15	7	6	2
Dessert	4	0	0	4
Hollandaise/Béarnaise	10	5	4	1
Mayonnaise	9	5	3	1
Mayonnaise – flavoured	26	15	10	1
Pooled egg	5	0	0	5
Total	69	32 (43%)	23 (33%)	14 (20%)

Most pathogenic bacteria do not grow or produce toxins at a pH of 4.6 or less. IFT/FDA concluded that a pH of 4.2 or less could be used as a control measure for preventing the growth of *Salmonella* (IFT/FDA, 2003). Approximately half the dressings tested in this survey had a pH greater than 4.2 and almost 71% were stored above 5°C, conditions that might permit *Salmonella* to grow.

Using predictive growth and survival models[8] for *Salmonella* shows that storage of a raw egg dressing at 5°C with a pH of either 4.2, 4.8 or 5.8 should inhibit the growth of *Salmonella.* Storage at 10°C is less effective, particularly for dressings that have not been acidified correctly (above pH 4.2). When stored at 10°C, a dressing with a pH of 5.8 could allow *Salmonella* to potentially increase by 1.5 – 2 log cfu/g (30 – 100 fold increase) over three days. Storage of dressings with a pH of 5.8 at a temperature of 20°C could lead to a 3 – 6 log (1000 to 1,000,000 fold) increase in *Salmonella* in just over 24 hours (Figure 1). Egg products can provide nutrients for bacteria regardless of whether or not pasteurised egg is used, so cross contamination must be controlled.

[8] Predicted growth displayed in Figure 1 and 2 use the ComBase model (www.ComBase.cc) and Pathogen Modeling Program and assumes no lag phase with a constant water activity value of 0.997

Using the same conditions, survival and growth models for *B. cereus* shows that storage of raw egg dressings at 5°C, 10°C or 20°C, with a pH of either 4.2 and 4.8, should inhibit the growth of *B. cereus*. However growth of *B. cereus* in a dressing with a pH of 5.8 is not inhibited at any of these temperatures (Figure 2). *B. cereus* spores can be introduced to raw egg dressings and sauces via ingredients commonly used in these products such as spices and herbs.

A dressing with a pH of 5.8 stored at 5°C could allow *B. cereus* to potentially increase by 1.5 to 2.7 cfu/g log (30 – 500 fold increase) over three days, while storage at 10°C allows *B. cereus* to increase by 3.5 – 5.9 log cfu/g (3000 – 800,000 fold increase) over three days. Storage at 20°C could lead to a 6 log cfu/g (1,000,000 fold) increase in 24 hours, levels that would be sufficient to cause food poisoning.

The responses to survey questions showed that some dressings were stored for much longer periods than this. Figures 1 and 2 demonstrate the importance of ensuring raw egg dressings that have a high pH are stored under temperature control to minimise the potential growth of bacteria.

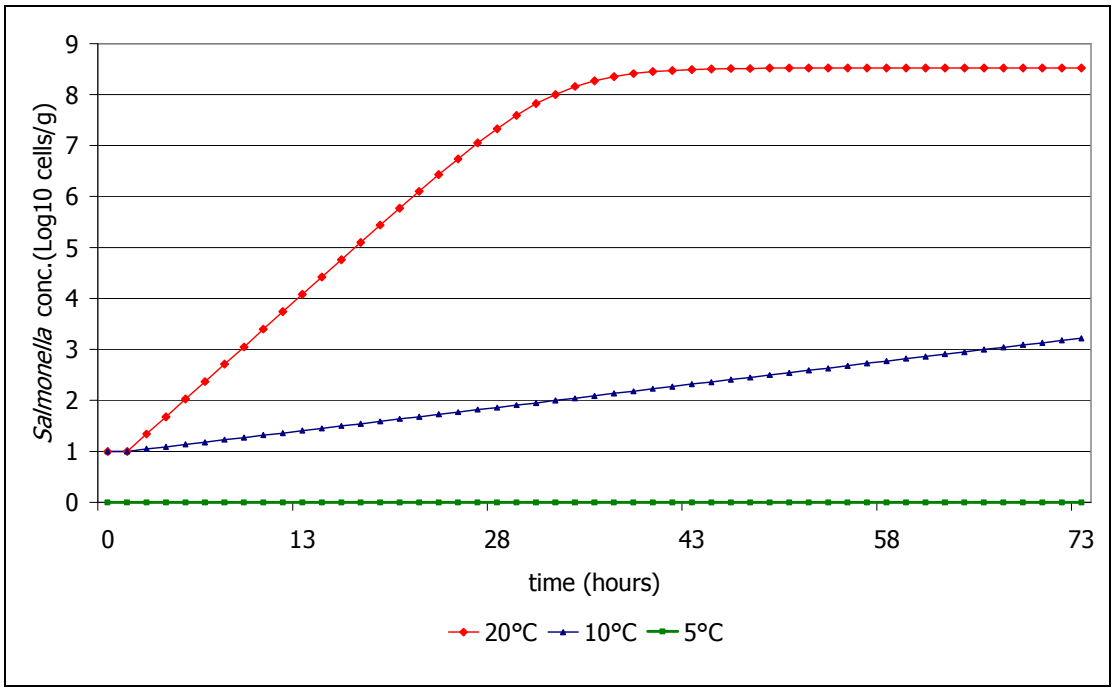

Figure 1: Predicted survival and/or growth of *Salmonella* in raw egg dressing with a pH of 5.8 stored at different temperatures (using ComBase model)

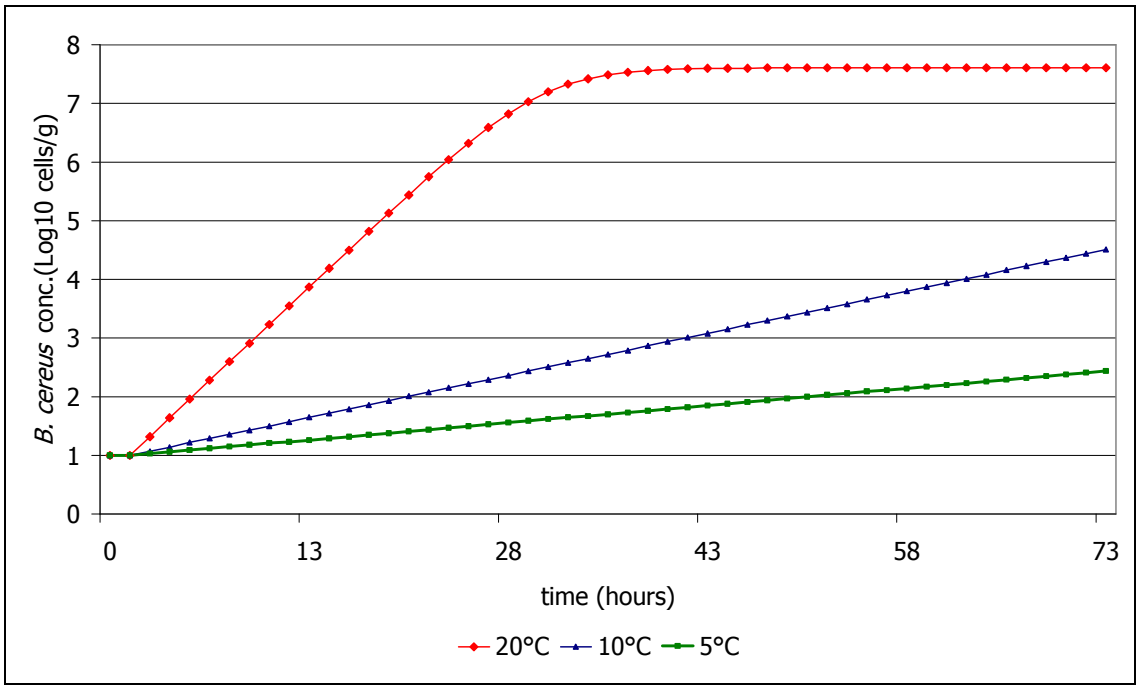

Figure 2: Predicted survival and/or growth of *B. cereus* in raw egg dressing with a pH of 5.8 stored at different temperatures (using ComBase model)

Temperature

Sixty-six samples had their temperature measured at the time of sampling. The majority (71%) of products had a temperature between 5°C and 60°C (Figure 3).

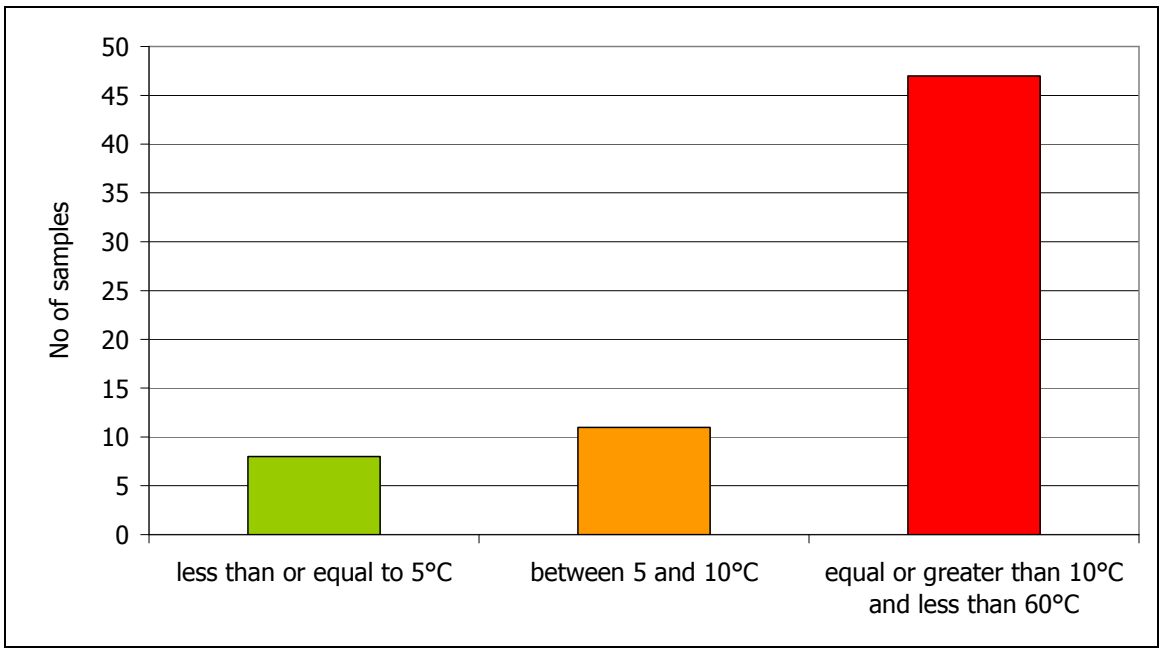

Figure 3: Temperature of samples at time of sampling

Container type

Almost half the products sampled were stored in squeeze bottles or sauce dispensers (Figure 4). These were then stored in and out of temperature control for convenience during service. Often, sauce dispensers were observed to be dirty round the rim and topped up without washing and sanitising. Refilling sauce bottles without washing and sanitising can be a major food safety hazard. Old product, if contaminated or subjected to temperature abuse and then left in the bottom of the bottle during refilling, will contaminate any new product added. The issue of refilling bottles without washing and sanitising between fills has previously been identified as an issue by Authority officers during foodborne illness investigations.

Figure 4: A typical container used to store dressings and sauces

Due to the design of sauce dispensers, adequate cleaning and sanitising of the bottles, lids and nozzles can be difficult. Effective washing and sanitising of equipment associated with raw egg dressings is essential as *Salmonella* can multiply over time on equipment and re-contaminate food. It was also observed that many businesses were preparing bucket sized bulk mixes of raw egg dressings for use over a week or longer. These bulk mixes were generally stored in the cool room and used to top up smaller tubs/sauce dispensers. As with other foods stored in bulk, rapid temperature reduction is difficult to achieve due to the size and shape of the container.

While sauce dispensers are usually stored in a cold display unit, they often do not remain under effective temperature control due to the nature of the container material (ie plastic) and the low surface area on the bottom in contact with a cold surface (unless in a fan assisted cold display).

- Ten (10%) of raw egg dressings were stored at ambient conditions when sampled (Figure 5) ie not in a fridge or cold bar
- 39 (36%) were stored in the fridge
- 23 (21%) were stored in a cold bar. Of these 13 had a temperature over 5°C (four samples had no temperature recorded) indicating issues with keeping these products under temperature control in cold bars.

Usually raw egg hollandaise is served at room temperature or lightly heated. Hollandaise is generally stored within heated areas or under heat lamps which heats the sauce to approximately 40°C; within the temperature danger zone and close to the optimum temperature for pathogen growth of 37°C. Some businesses verbally advised that they had implemented the 4-hour / 2-hour rule but no documented evidence was available to demonstrate how they were applying this alternative method of compliance.

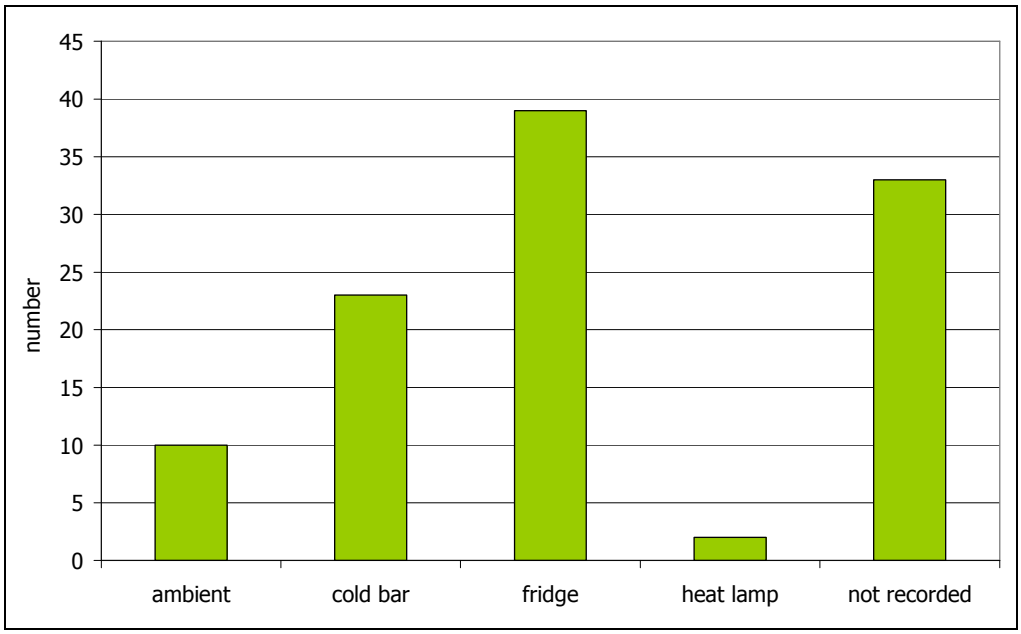

Figure 5: Storage of raw egg dressings during service

Shelf life policy

Information was collected on the shelf life policy on 86 samples. Of these, 74% (n=64) were not date coded and 41% (n=44) did not have a known shelf life policy during the inspection. The shelf life policy of products sampled is outlined in Figure 6. Some dressings stored in bulk were noted to be up to three weeks old.

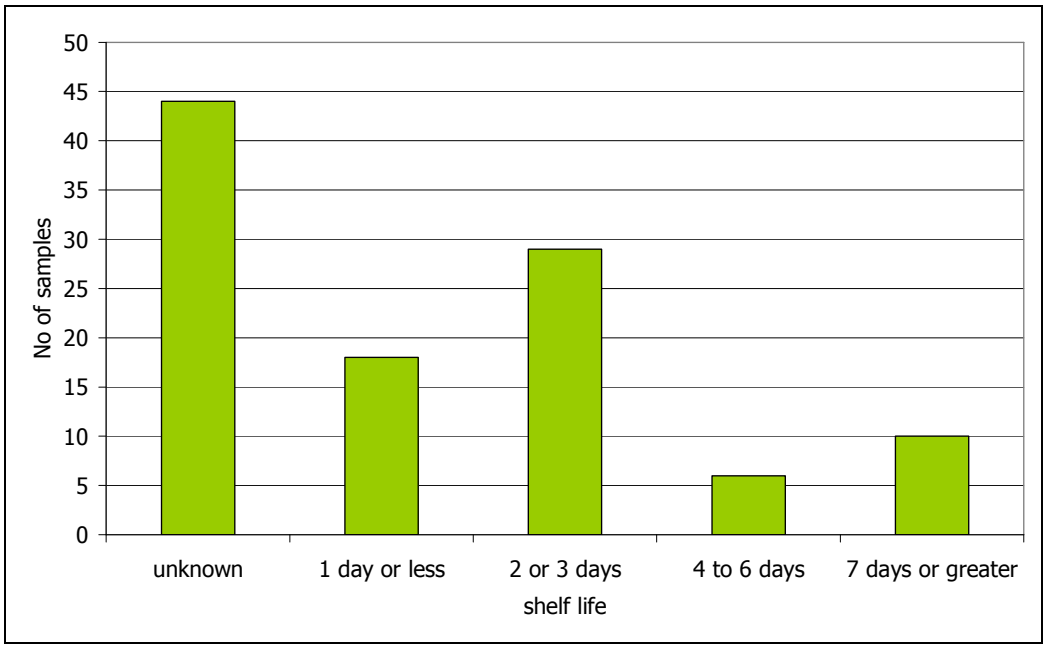

Figure 6: Shelf life policy of samples

Product preparation

Information on the storage and quality of eggs used in the preparation of raw egg dressings was collected in 44 premises.

Most raw egg dressings were made with eggs where the yolk and white were separated at some stage during preparation. Thirty-nine premises were surveyed on how they separated eggs (Figure 7). The majority of premises surveyed separated eggs by hand; four using gloved hands and seventeen using bare hands. Five premises separated eggs using the shells. In addition, three premises indicated they used a combination of methods including hands and shells, and hands and separator. One premises indicated they did not separate eggs. The remainder were unsure of how eggs were separated as the chef was not onsite during sampling.

It is recommended that shells not be used to separate eggs as any contaminant on the surface of the shell can be transferred to the contents.

Separating eggs using bare hands is also a concern. Hands may become contaminated if *Salmonella* is present on the shell and result in cross contamination to the egg contents, other products and surfaces.

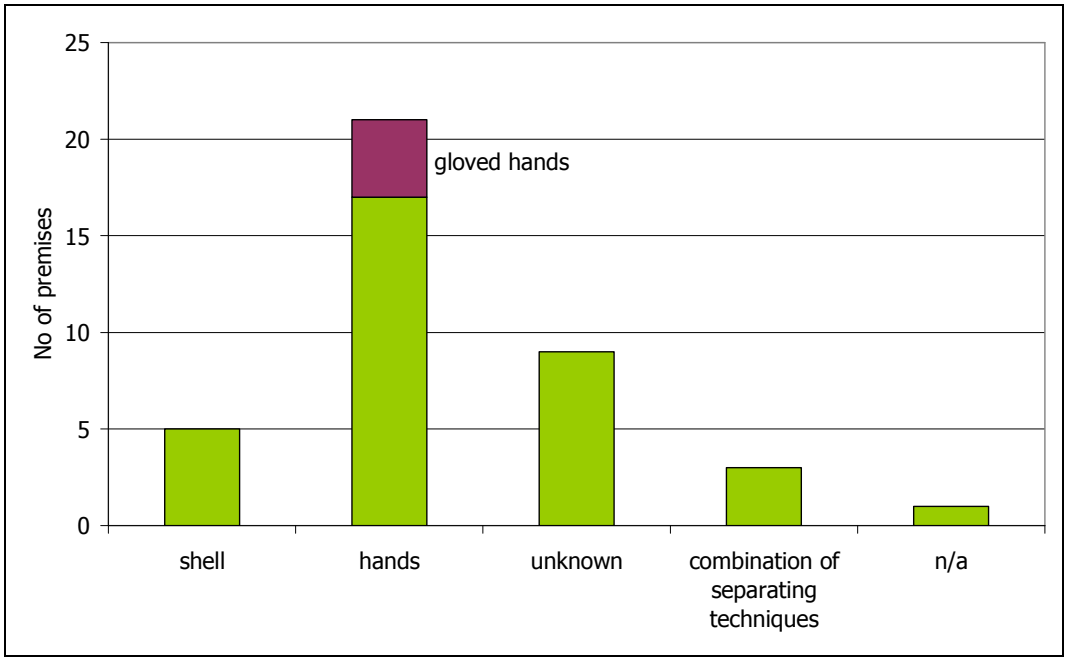

Figure 7: Egg separation techniques used

In general, it appears that hand washing after handling eggs was not considered as important as washing hands after handling raw poultry or meat. Previous studies have reported the detection of *Salmonella* on the hands, work surfaces and utensils after use of contaminated eggs as well as isolated from utensils after washing and from surfaces 24 hours after use (Humphrey, Martin & Whitehead, 1994, NSW Food Authority, 2010, Mannes, et al, 2010). Previous foodborne illness investigations by the Authority have detected *Salmonella* in retail outlets on chopping boards, preparation benches, piping bags, cleaning cloths, freezers, sinks, display units, door handles and plastic decorations used in display cabinets (unpublished data).

Just over half (52%) of the food businesses stored eggs under 5°C. This is consistent with a UK survey in 2005–7 which found 55% did not store eggs under refrigeration (Food Standards Agency, n.d.). Many operators did not know whether eggs were delivered below 5°C due to early deliveries and appropriate staff not being present. There was a distinct lack of knowledge regarding the quality of the egg and the egg supplier.

Twenty-three percent of premises (n=10) had cracked or dirty egg shells in storage (figure 8). This seems to be a high proportion especially since some of these businesses received eggs from HACCP approved egg suppliers. It appears that some issues exist around the storage of eggs leading to damage in busy kitchen environments. Cracking can also occur during transportation. Raw shell eggs should be protected during storage to prevent damage. This will also help prevent cross contamination through the shell.

Many premises did not know the shelf life of their eggs in stock and some had even removed the 'best before' date (by either removing the outer packaging or transferring the eggs to another container).

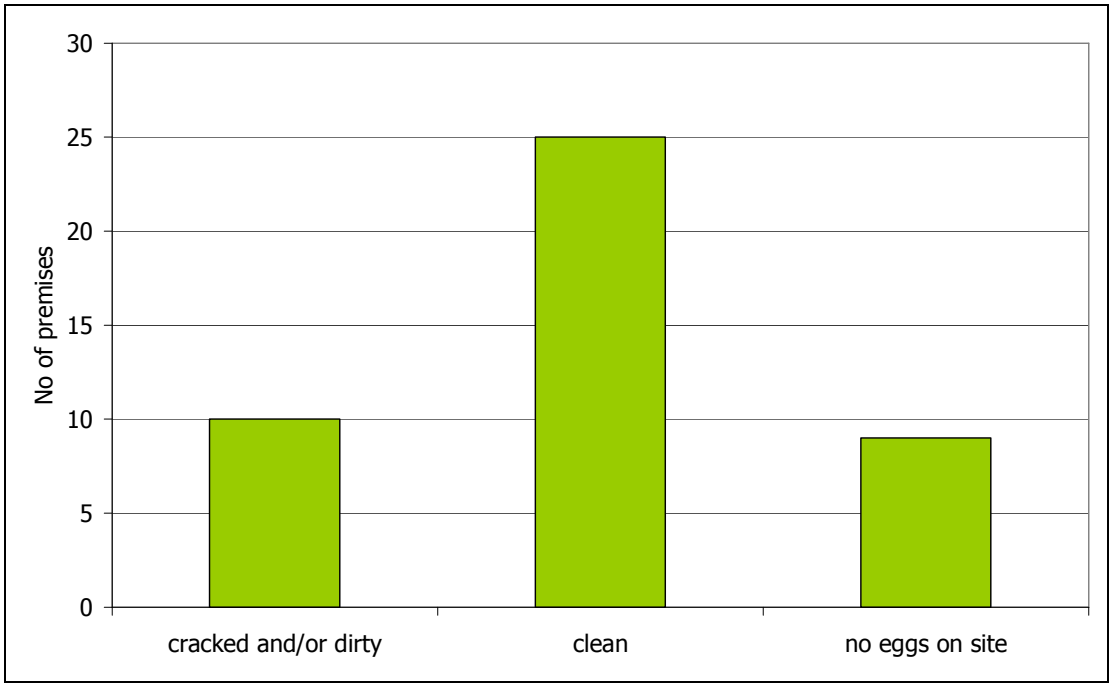

Figure 8: Visual appearance of eggs found on site

Conclusion

Raw egg dressings are widely used across the City of Sydney LGA. To adequately control the potential growth of *Salmonella* and other foodborne pathogens in raw egg dressings, there are two potential control measures, either:

- dressings must be acidified to a pH value at or below 4.2 by using a verified recipe, or by checking the pH value of every batch, or
- any dressing that is not at a pH of 4.2 or below must be stored under temperature control (at or below 5°C or according to the 4-hour / 2-hour rule).

The responses gathered in this survey tended to indicate that certain basic practices were not routinely carried out and the majority of businesses required improvement in:

- temperature control of raw egg products during and in between use
- date coding and shelf life setting of raw egg products
- egg separation technique during processing
- cleaning and sanitation of storage and display containers
- receipt and storage of shell eggs

Although the majority of samples were classified good or acceptable microbiologically, twelve percent were classified unsatisfactory and one percent was classified potentially hazardous.

It appears that a high proportion of business do not feel it is a viable option to change over to a commercial product or pasteurised egg product. With this in mind, more specific guidance is needed to improve the safety of existing raw egg dressings.

According to industry, pasteurised egg yolks are difficult to obtain and not a practical alternative to raw shell eggs. In general, businesses did not know where to get pasteurised egg yolks from and those that have sought pasteurised egg pulp have found it difficult to find a supplier to meet their needs. While pasteurised egg is sold either frozen or fresh, it is in too large a batch for small to medium food premises. Some chefs also feel the quality of the final product is affected when using pasteurised egg yolks.

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Appendix

Ready to eat raw egg dressings – sampling questionnaire

1	Officer and date	
2	Premises name and address	
3	Owner of food business (Company/sole trader)	
4	Name of person in charge and designation	
5	Contact details	
6	Sample type taken (eg hollandaise, mayonnaise, Caesar dressing, tartar sauce, béarnaise). Consider desserts if possible issues eg Tiramisu.	
7	Sample label ref (eg COSREDKD1)	
8	Description of conditions held in (eg in a dirty sauce dispenser sitting on work bench in ambient temperature)	
9	Temperature of dressing at time of sampling.	
10	Date and time product alleged to be made?	
11	Is the dressing date coded?	Y/N
12	Shelf life policy for product (eg 2 days?) How long in to the shelf life is the product? (eg 3rd day of 5 days)	Y/N
13	How are raw egg dressings stored generally?	
14	How are raw egg dressings displayed generally?	
15	How is the product made? (where are the eggs cracked/separated – separate area?)	
16	Is the bulk/pooled egg mix made up and used for other things eg desserts and other sauces?	Y/N
17	How is the associated equipment cleaned and sanitised?	
18	Are whisks used? If so how are they cleaned/sanitised?	
19	How often are squeeze bottles and other containers cleaned and disinfected?	

20	How are the whites separated from the yolks?	
21	Other ingredients used – comment on storage conditions and temp checks.	
22	Do they routinely wash hands after handling raw eggs?	
23	Comments on general condition of premises (risk rating)	
24	Egg supplier? Reputable? (eg major brand, carton adequately labelled)	Y/N
25	If eggs not purchased from a supermarket does name on carton match invoice?	Y/N
26	Egg supplier HACCP approved?	Y/N
27	How are eggs delivered?	
28	Are the delivery temps for eggs less than 5°C?	
29	Type/temperature of egg storage? (eg cool room at 5 degrees Celsius)	
30	Comments on condition of eggs (eg cracked/dirty egg shells, risk of cross contamination with other foods etc) VERY IMPORTANT	
31	Are the eggs within their best before date?	Y/N
32	General hygiene of the business (important risk factor in raw egg associated outbreaks) Are practices sufficient to prevent cross contamination within the premises? Is sanitiser used regularly and correctly on surfaces/equipment?	
33	Is the business aware of alternatives to raw egg? (eg pasteurised egg pulp and or commercial pasteurised mayonnaise)	