Food Authority

Food safety guidelines for the preparation of raw and lightly cooked egg products

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Introduction

In Australia, foodborne illness caused by Salmonella has significantly increased over the past 20 years and more than seventy percent of salmonellosis is thought to be due to contaminated food (Davis et al., 2022; Ford et al, 2016). Mishandling of eggs and egg-based products is a significant contributor to foodborne illness in Australia, and in NSW.

Salmonella is known to be present on the surfaces of eggs and improper handling can lead to raw egg products becoming contaminated.

There are a number of factors that contribute to the strong association between foodborne illness outbreaks caused by Salmonella and food that is sold which contains raw egg. These include:

- Contamination of egg contents by Salmonella from the shell,
- Failure to process raw egg foods sufficiently (through acidification or heat) to remove any Salmonella risk,
- Failure to clean and sanitise equipment and food contact surfaces,
- Temperature abuse of products (i.e. storage above 5°C), and
- Keeping raw egg products beyond the recommended storage life (maximum 24 hours) at refrigerated temperature.

The practice of pooling eggs to produce raw egg foods significantly increases the likelihood of Salmonella contamination of a product which does not receive any further cooking or treatment to eliminate harmful bacteria.

Many large outbreaks of Salmonella food poisoning linked to raw egg foods have occurred in NSW and nationally, particularly where business hygiene and temperature control issues were apparent.

Raw egg products that are most commonly implicated in Salmonella food poisoning include:

- Sauces and spreads made with raw egg – for example mayonnaise, aioli, egg butter.
- Desserts made without an effective cook step – for example tiramisu, mousse, fried ice cream.
- Drinks containing raw egg – for example egg flip, raw egg high protein smoothies.

The easiest solution to reduce the risk of a retail food business being implicated in a foodborne illness outbreak caused by Salmonella is to avoid selling food containing raw egg. If a food business decides to prepare and sell raw egg products, the business chooses to accept the inherent food safety risk and is responsible for effectively managing the risk and producing safe food.

All food business should be able to identify and control food safety risks to ensure that they can meet the requirements of the Australia New Zealand Food Standards Code (Food Standards Code). In order to protect customers from the risk of foodborne illness, businesses must comply with Standard 3.2.2, Division 3, Clause 7 (see below) to ensure that only safe and suitable food is processed.

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 microorganisms in the food is minimised.

This is particularly important for food businesses such as restaurants, cafés, bakeries and caterers that prepare and sell food containing raw egg.

Understanding the risk in the preparation of raw egg products, the NSW Food Authority has developed these guidelines to assist businesses to undertake practices that will ensure that they comply with food safety requirements when making products with a known history of causing salmonellosis.

The following guidance is recommended:

1. Use safer alternatives to raw eggs in foods which are not cooked. Alternatives include commercially produced dressings and sauces, or pasteurised egg products.
2. If using a raw egg product is the only option, then all of the following controls must be in place:
    a. Egg receival – only buy eggs from reputable suppliers with appropriate delivery and storage conditions. No cracked, dirty or unstamped eggs,
    b. Storage – correct storage and display of ingredients and products, including proper temperature control,
    c. Processing – correct handling such as good personal hygiene (including good hand washing practices and proper use of gloves if used), use of a sanitised egg separator, and proper temperature control,
    d. Premises – clean premises, fixtures, fittings and equipment, compliant hand wash facility, sanitised equipment (including egg separator) and food contact surfaces,

AND for foods containing raw egg, with a history of causing salmonellosis or of a very similar nature to those foods, steps e) and f) below:

    e. The product is to be acidified to a pH of 4.2 (or less) or effectively heat treated.

Foods containing raw eggs must be acidified to a pH of 4.2 (or less) through the addition of acidic ingredients such as lemon juice or vinegar

OR

Receive effective heat treatment such as sous vide or pasteurisation to eliminate Salmonella, if present.

    f. The treated raw egg product should be stored at or below 5˚C for no longer than 24 hours and should be discarded at the end of the day. A fresh batch should be made daily.

Note:

Under the Food Standards Code Standard 3.2.2 Division 3, to prevent disease causing bacteria from growing or producing toxins, the temperature of products must be either at or below 5˚C during transport, storage and display. The Food Standards Code allows for alternative compliance methods provided the businesses can demonstrate the product's safety (Standard 3.2.2, Clause 25).

The '2-hour/4-hour rule' is used by Food Standards Australia New Zealand (FSANZ) as an example of an alternative method for compliance (see page 14). If a business uses the '2-hour/4-hour rule', then a documented system must be in place to demonstrate evidence that it is being used effectively.

Purpose and scope

The purpose of these guidelines is to give food retail businesses that sell food containing raw egg specific safety steps for its preparation and clear guidance and advice on how to meet food safety regulations. These businesses are strongly advised to follow this guidance document.

The document covers areas from receipt of eggs through to preparation of raw egg products. These areas can all potentially affect the safety of the product. It also includes an example of a monitoring system for use when acidifying raw egg products.

This document **applies to** the foods that contain raw or lightly cooked egg known to have caused cases of salmonellosis, including:

- Sauces and spreads such as mayonnaise, aioli and egg butter
- Desserts such as tiramisu, mousse and fried ice cream
- Drinks such as shakes and smoothies.

Recommendations 2(e) and 2(f) (on page 5) as laid out in this guideline **do not apply** to certain products that contain raw or lightly cooked egg but have little or no history of causing salmonellosis due to their traditional method of preparation, use or storage including:

- cooked egg sauces for example hollandaise and béarnaise sauce
- cooked breakfast style eggs such as scrambled or poached eggs and omelettes
- cakes and soufflés (baked)
- meringues (oven baked)
- icing (high sugar content)
- marshmallows (boiled during preparation)
- frozen desserts such as ice cream or frozen mousse (frozen immediately after preparation)
- traditional dishes that incorporate a raw egg added when serving such as tartare, congee, and soups.

All food businesses must meet the requirements of the Food Standards Code to ensure they follow safe food handling practices. This document does not cover all requirements of the Food Standards Code, in particular requirements relating to premises and equipment. Business operators must read the Food Standards Code and ensure they comply with all aspects of the Food Standards Code as it relates to their business.

Acknowledgements

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Definitions

Term	Definition
Acidified product	Product with vinegar/lemon juice/other acid added to achieve a pH of 4.2 or less.
Authorised Officer	A definition of an Authorised Officer is included in the Food Standards Code (Standard 1.1.2) and also defined in the NSW Food Act 2003 Part 1. The appointment of Authorised Officers and Certificates of Authority are set out in NSW Food Act 2003 Part 9 Division 3.
Cleaning	The process of removing food and other types of soils from surfaces, equipment and utensils. Detergents are used to assist removal.
Cracked egg	An egg which has a cracked shell which is visible, or visible by candling or other equivalent method, and includes a broken egg. Food Standards Code 4.2.5, Division 1, Clause 2 Hairline cracks often escape visual detection and can worsen as eggs move through the supply chain.
Dirty egg	An egg that has visible faeces, soil or other matter on it (for example yolk, albumen, feathers). Food Standards Code 4.2.5, Division 1, Clause 2
Egg	An egg from any avian (bird) species, except ratites Food Standards Code 4.2.5, Division 1, Clause 2
Egg pulp	The contents of an egg, which may contain sugar or salt. Food Standards Code 4.2.5, Division 1, Clause 2
Foods sold containing raw egg	Food that is prepared with raw egg and consumed without further processing (for example without cooking). Examples include: Sauces and spreads made with raw egg – for example mayonnaise, aioli, egg butter. Desserts made without an effective cook step – for example tiramisu, mousse, fried ice cream. Drinks containing raw egg – for example egg flip, raw egg high protein smoothies.
Liquid egg white	The white of egg separated as effectively as practicable from the yolk in liquid form. Food Standards Code 4.2.5, Division 1, Clause 2
Liquid egg yolk	Yolk of egg separated as effectively as practicable from the white in liquid form. Food Standards Code 4.2.5, Division 1, Clause 2

Term	Definition
Pasteurisation of egg product	A control measure where eggs are subjected to a process, using heat to reduce the load of pathogenic microorganisms to an acceptable level to ensure safety.
Pathogenic bacteria	Bacteria capable of causing food poisoning for example Salmonella.
Potentially hazardous foods	Food that has to be kept at a certain temperature to minimise the growth of any pathogenic bacteria that may be present in the food or to prevent the formation of toxins in the food. Food Standards Code 3.2.2, Division 1, Clause 1
Ready-to-eat foods	Food that is ordinarily consumed in the same state as that in which it is sold and does not include nuts in the shell and whole, raw fruits and vegetables that are intended for hulling, peeling or washing by the consumer. Food Standards Code 3.2.2, Division 1, Clause 1 For retail businesses this would include cooked foods or other foods that have various dressings (for example raw egg mayonnaise acidified to pH less than or equal to 4.2)
Sanitising	To apply heat or chemicals, or heat and chemicals, or other processes, to a surface (for example food contact surfaces of equipment, eating and drinking utensils) so that the number of microorganisms on the surface is reduced to a level that: does not compromise the safety of the food with which it may come into contact does not permit the transmission of infectious disease Food Standards Code 3.2.2, Division 5, Clause 20(2)(b) There are two methods available: Heat – to sanitise effectively with heat only, temperature of at least 77°C and a contact time of greater than 30 seconds is required. Lower temperatures will require longer contact times. If using a dishwasher, check the manufacturer's instructions to ensure adequate temperature/time is achieved. Chemical sanitiser – generally chlorine or ammonium-based compounds. It is important to choose the right product for the food premises and to follow the manufacturer's instruction especially for dilution rate, contact time and safety instructions.
Shelf-stable foods	Foods which can be stored unrefrigerated without affecting their safety or quality.
Sous-vide pasteurised eggs	Eggs that have been exposed to a mild heat treatment in a water bath to kill Salmonella that may be present, without actually cooking the eggs.
Temperature control	Means maintaining food at a temperature of: 5°C or below if this is necessary to minimise the growth of infectious or toxigenic microorganisms in the food so that the microbiological safety of the food will not be adversely affected for the time the food is at that temperature; or

Term	Definition
	60°C or above; or another temperature – if the food business demonstrates that maintenance of the food at this temperature for the period of time for which it will be so maintained, will not adversely affect the microbiological safety of the food. Food Standards Code 3.2.2, Division 1, Clause 1
Validate	Validate means: Confirming a control measure for a critical control point or process is effective to minimise a food safety hazard; and Providing objective evidence to confirm paragraph (a) Food Standards Code 4.2.5, Division 3, Clause 21

Receiving and storing eggs & other food

Food safety begins by ensuring only safe and suitable ingredients are purchased from a supplier and that these items are stored correctly. The following information is provided to assist meeting the requirements of the Food Standards Code regarding the receipt and storage of food.

Receiving eggs

- Only accept eggs that are:
  - clean,
  - free from visible cracks and not leaking,
  - stamped,
  - supplied in clean packaging, and
  - correctly labelled (i.e. with the supplier's name and address, date marking).
- Check the eggs when they arrive and always reject eggs that are broken, cracked or dirty, or that are supplied in dirty, defective, re-used or improperly labelled packaging. Accepting eggs in poor condition places your business at risk.

Supplier and food information

- A list of food suppliers should be maintained in case they need to be contacted.
- For all foods, the label or receipt needs to contain details of suppliers' names and addresses. Phone contact details should also be kept.
- Items that do not meet the above receiving and information requirements should be returned to the supplier.

Storage of whole eggs

- Store whole eggs (egg in shell) in a refrigerator or cool room.
- Avoid temperature fluctuations and only take out what is required for service.
- Don't store fresh egg pulp that has been collected (pooled) in a container.
- Ensure proper stock rotation so that the oldest stock is used first (as long as they are still within the best before or use-by-date).
- Discard any cartons that contain spilt raw egg to avoid contamination.
- Eggs should not be re-packed into cartons with labels that do not correctly reflect the origin, weight or egg type.

Other foods

Potentially hazardous foods must be stored under refrigeration at or below 5°C. This includes meat, chicken, seafood, dairy products and eggs.

- Only receive foods that are within their 'Use-by' date or 'Best Before' date.
- Only receive potentially hazardous food that has been transported under temperature control.
- Once received, all potentially hazardous foods must be placed under refrigerated storage at or below 5°C.
- Refrigerated raw ingredients must be stored separately from ready-to-eat foods and ingredients.
- Raw foods such as uncooked chicken and meat must not be placed above ready-to-eat foods in the refrigerator to prevent the raw juices from dripping onto the ready-to-eat foods.

- Refrigerated unpackaged foods and ingredients must be covered during receipt and storage to protect against contamination.
- Store foods in accordance with the manufacturer's instructions.
- Ensure proper stock rotation so that the oldest stock is used first (as long as they are still within date).

Egg handling practices – practical steps to control Salmonella

Preparing foods can involve a great deal of handling of both raw and cooked foods. Because raw egg products are eaten without any further cooking it is important that they are prepared correctly and safely.

Raw foods can contain bacteria and if the food is not handled correctly, the numbers of bacteria can grow. Poor handling of cooked foods can result in cross-contamination from raw foods and if not stored correctly, the number of bacteria can also grow.

Below are some main points to assist in proper preparation of foods, particularly raw egg products, and to help avoid cross-contamination. For further information, refer to Standard 3.2.2 of the Food Standards Code.

Premises

The cleanliness of the premises, fixtures and fittings assist in minimising cross contamination. In particular it is important to have an acceptable hand washing facility that includes:

- warm running water,
- soap,
- single-use hand towels, for example paper towels.

Equipment, utensils, and food contact surfaces

- All equipment and utensils must be in good condition and able to be easily cleaned and sanitised.
- Mechanical equipment, such as blenders and food processors, should be able to be easily taken apart for cleaning and sanitising. If they cannot be taken apart, equipment like stick blenders may not be appropriate for processing raw eggs.
- Food contact surfaces such as equipment, benches and utensils must be cleaned and sanitised before use.
- Boards and utensils must be cleaned and sanitised between preparing different foods, especially when preparing foods that will not be further cooked (for example raw egg products).
- Use a sanitised egg separator to separate egg yolk from egg whites. Eggs must not be separated using their shells as the shells may be contaminated with Salmonella on the outside surface.

Personal Hygiene

All food handlers must take all reasonable measures not to handle food or surfaces likely to come into contact with food in a way that is likely to compromise the safety and suitability of food.

Food handlers must ensure they follow good personal hygiene practices:

- People who are sick with vomiting, diarrhoea or fever must not prepare or serve food.
- Take all practicable measures to prevent unnecessary contact with ready-to-eat food.
- Wash hands prior to preparing food and after handling non-food articles, using the toilet, smoking, drinking, eating and touching hair, scalp or body.
- Wash hands between handling of raw ingredients and ready-to-eat foods.

Use of disposable gloves

It is not mandatory for food handlers to use disposable gloves, although if used correctly they can assist with minimising contamination.

When using disposable gloves, they must be:

- Only used for one continuous task and then discarded.
- Regularly changed to avoid cross-contamination – this is especially the case when changing from preparing raw ingredients to handling ready-to-eat foods.
- Always discarded and not kept for later use once taken off.
- Removed and discarded before using the toilet, smoking, eating, drinking or touching the hair, scalp or body.

Temperature control

- Temperature control throughout the operation is critical in minimising microbial growth, for example raw egg product must be at or below 5˚C. This includes all operations during receipt, processing, storage and display.
- If a raw egg product is out of temperature control (i.e. not at or below 5˚C), there must be documented evidence that the '2-hour/4-hour' rule is being met.

> *2-hour/4-hour rule*
> *When potentially hazardous ready-to-eat food has been kept between 5˚C and 60˚C for:*
> *up to 2 hours, it can be refrigerated below 5˚C, or kept hot above 60˚C, or used immediately,*
> *between 2 and 4 hours, it must be used immediately, or*
> *up to a total of 4 hours or more, it must be thrown out.*
> *Safe Food Australia – Appendix 2 (2016)*

For a more detailed information on the 2-hour/4-hour rule, refer to the 'Guidance on the 2-hour/4-hour rule' document on the NSW Food Authority's website www.foodauthority.nsw.gov.au/resource-centre.

Temperature measuring device

- Businesses handling potentially hazardous foods must have a temperature measuring device.
- Thermometers must be easily accessible and able to accurately measure temperatures to +/- 1°C.
- Thermometers should be calibrated to ensure accuracy.
- Appendix 4 provides information on calibrating thermometers.

Handling of eggs

Because eggs can be contaminated with Salmonella on the surface, the handling of eggs is critical. When handling eggs, follow these guidelines:

- Do not use dirty, cracked or unstamped eggs.
- Do not wash eggs. Washing makes them more susceptible to contamination. Discard dirty and cracked eggs.
- Visually inspect eggs before use to ensure there are no hairline cracks.
- Use raw egg pulp immediately – i.e. do not pool or store raw egg batches.
- Use a sanitised egg separator.
- Regularly prepare fresh batches of raw egg mixture:

- For acidified egg product: document pH and storage times, store for a maximum of 24 hours at or below 5˚C (See Appendix 1).
- If any raw egg product is out of temperature control (i.e. not at or below 5˚C), then storage times and temperatures must be documented to demonstrate evidence of compliance with the '2-hour/4-hour rule' (see Appendix 3).

Raw or lightly cooked egg products – process controls

If a food business decides to prepare raw egg containing foods that do not undergo a pathogen control step, the foods should be prepared in line with safe food handling practices to slow the growth of Salmonella and minimise the risk of foodborne illness.

A pathogen control step is a process such as cooking, pasteurisation or retorting to reduce any pathogens that may be present in the food to safe levels.

Preparation of acidified raw egg products

Correct preparation of acidified raw egg product (using vinegar, lemon juice or other acids) improves product safety:

- Product acidified to a pH of less than 4.2 inhibits the growth of pathogenic bacteria, including Salmonella.
- Acidification should occur as part of the preparation step and should be checked to ensure proper acidification has occurred. An example worksheet is provided in Appendix 1.
- It is important that the pH is measured and recorded as evidence to show that all practicable measures are being taken to process safe and suitable food.
- Once acidified, the product must be covered when not being used.
- It is important that the product is kept at or below 5°C or that the '2-hour/4-hour' rule is observed.
- Acidified product must be discarded at the end of the day and a new batch prepared daily. Product must not be stored for longer than 24 hours.

Preparation of desserts

Using pH as a means of control may not work with desserts (although some desserts may include the use of acids or lemon juice).

Other ways to help make non-acidified raw or lightly cooked egg desserts safer are to:

- Use eggs that are commercially pasteurised in shell, liquid, frozen or dried.
- Use eggs pasteurised in-house using a sous vide method or other in-house pasteurisation process (see below).
- Consider the use of other controls such as lowering the water activity (aw).

In shell egg pasteurisation using a sous vide method

Eggs can be pasteurised in shell using a sous vide method. An example recipe for sous vide pasteurised shell egg is to hold the eggs in a water bath at temperature of 57°C for at least 75 minutes (Baldwin, 2022). The pasteurised eggs can then be used in sauces or desserts, just like raw eggs.

Correct procedures should be followed to ensure the eggs are safe to use:

- Every batch of sous vide cooking should be documented. An example worksheet is provided in Appendix 2.
- Commercial equipment with adequate heating capacity and precise temperature control should be used.

- Correct water temperature is essential for sous vide, and it should be checked using a tip sensitive digital thermometer that is accurate to 0.1°C.
- Raw shell eggs must be fully immersed in the water bath.
- Avoid overcrowding of eggs in the water bath. Overcrowding can affect cooking times. The time of cooking will need to be increased to compensate.
- Eggs cooked using sous vide methods should be used immediately or cooled and refrigerated.
- If eggs are to be stored, they should be rapidly cooled in a 50:50 ice-water bath. Once cooled, they should be stored at or below 5°C in their shells for a maximum of 10 days. They should be clearly labelled and stored separately from raw eggs.

Pasteurisation of egg products

Standard 4.2.5 Division 3 Clause 21 of the Food Standards Code specifies the time and temperature combination to pasteurise egg products.

Egg Products	Retention[#] temperature to be no less than (°C)	Retention time to be no less than (minutes)	Maximum temperature to be immediately rapidly cooled to (°C)
Egg pulp (without any sugar or salt)	64	2.5	≤ 7
Liquid egg yolk	60	3.5	≤ 7
Liquid egg white	55	9.5	≤ 7

[#] Retention time and temperature means the time required after the centre of the product achieves the specified pasteurisation temperature.

Some egg products, such as those containing salt and sugar, may require higher pasteurisation times and temperatures to eliminate Salmonella. FSIS USDA (2020) provides guidance for combinations of times and temperatures to give a 5-log reduction of Salmonella.

Egg products	Retention# temperature to be no less than (°C)	Retention time to be no less than (minutes)
Salted whole eggs (with 2% or more salt added)	63 62	35 6.2
Sugared whole eggs (2 – 12% sugar added)	61 60	3.5 6.2
Salted yolk (2 – 12% salt added)	63 62	3.5 6.2
Sugared yolk (with 2% or more sugar added)	63 62	3.5 6.2

[#] Retention time and temperature means the time required after the centre of the product achieves the specified pasteurisation temperature.

NOTE:
If a business would like to pasteurise the eggs using any other time & temperature combination or using any other process besides heating, the business must validate the process to confirm that the alternative process is effective in eliminating Salmonella.
It is the business' responsibility for ensuring that the food sold is safe and suitable.

Storage and display of raw egg foods

Food must be stored and displayed correctly to prevent cross-contamination. This includes:

- Food must be stored in a way that is protected from contamination and in the condition that will not adversely affect the safety and suitability of the food.
- Label the food with a 'Use-by date' to ensure only fresh batches are used.
- Do not top up or mix batches.
- For acidified raw egg products:
  - make fresh batches daily,
  - store at or less than 5°C, and
  - discard at the end of the day or store no longer than 24 hours.
- For sous vide pasteurised eggs:
  - store at or less than 5°C in their shells,
  - label with the date of pasteurisation, and
  - discard within 10 days of pasteurisation.
- If any raw egg product is brought out of refrigeration and held between 5° and 60°C, then the times and temperatures should be documented to demonstrate compliance with the 2-hour/4-hour rule. Businesses are strongly advised to keep raw egg products in a refrigerator or cool room at 5°C or less when not being used for service.

Documentation

Each business preparing and selling raw or lightly cooked egg products should document the following information. The information should be made available for verification by an authorised officer.

- Recipe of each raw or lightly cooked egg product – where possible, the recipe should aim to achieve a pH of less than 4.2.
- Intended use – for example, salad dressing or dips etc.
- Name of the egg producer and supplier, delivery date of the eggs and the relevant use-by date or batch codes.
- Name(s) of the chef/cook/maker of the raw egg product(s).
- Time and date of each batch of raw or lightly cooked egg product and the quantity – this information should also be recorded on each container of the product made at that time.
- Storage conditions – raw egg products should be kept at 5°C or below at all times other than during manufacture or serving; refrigerator temperatures should be checked and recorded daily with a calibrated thermometer.
- Time out of refrigeration – if the business is applying the '2-hour/4-hour' rule, the time of products outside refrigeration must be recorded.
- Time of disposal – raw egg products must not be kept past 24 hours after manufacture. Disposal of product should be verified by recording the batch number, the time disposed of and by whom (name and signature).

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Appendix 1. Acidification of raw egg products

At pH values of 4.2 or less, pathogenic bacteria do not grow, form spores, or produce toxins. Lowering the pH of a product to 4.2 or less could be used as a control measure for preventing the growth of Salmonella.

Acidification of raw egg product using vinegar, lemon juice or other acids to a pH of 4.2 or less will stop the growth of Salmonella bacteria but other bacteria, yeasts or moulds can still spoil the product.

The pH of the raw egg product must be checked to make sure it has reached the 4.2 limit.

Steps for measuring pH

The pH of a raw egg product can be measured using a pH meter, pH strips or pH paper, as follows:

- Once the raw egg product has been prepared, place a small sample (¼ cup) in a clean container.
- Dip the pH paper/strip directly into the raw egg product and compare with the colour chart.
- If using a pH meter, follow the manufacturer's instructions.
- Record the pH on the 'Raw egg product acidification' check sheet.
- If the pH is greater than 4.2, add more vinegar, lemon juice or other acids to the product, and mix.
- Take another sample and repeat the pH reading.
- Continue adding vinegar, lemon juice or other acids until pH is less than 4.2. If extra vinegar, lemon juice or other acids is needed, raw egg product recipes should be revised to account for the extra vinegar, lemon juice or other acids required.

Figure 1: Equipment needed for measuring pH values

Different pH measuring methods

pH paper

- The pH paper should be able to read pH in 0.3 units, although it is difficult to distinguish less than 0.6 of a unit.
- Incorrect readings can occur from improper handling (for example, contamination from hands).
- pH paper requires careful handling.

pH strips

- The strips should read pH in units of 0.5 or less, although it is difficult to distinguish less than whole units.
- pH strips are easy to use and do not require as careful handling as the pH paper.

Hand-held digital pH meter

- Meters read pH in 0.1 units with certainty.
- Some hand-held pH meters also measure the sample's temperature and compensate the measurement for sample temperature.
- The meter requires calibration before use with at least a single buffer (buffer pH 4.0 is suitable for acidified raw egg product).
- The pH meter comes with instructions but may require some training of operators.

Raw egg product acidification check sheet

Date of acidification	Time of acidification	Egg supplier	Amount made	pH (must be ≤4.2)	Person responsible	Date discarded (must be within 24 hours of preparation)	Comments

Appendix 2. Egg pasteurisation check sheet

Whole egg pasteurisation using a sous vide method

Date of sous vide pasteurisation	Temperature of water bath	Length of time of pasteurisation	Egg supplier	Number of eggs	Person responsible	Date discarded (must be within 10 days of pasteurisation)	Comments

Appendix 3. Applying the 2-hour/4-hour rule

The 2-hour/4-hour rule check sheet

Date	Food Description	Time taken out of refrigeration	Activity	Time placed back in refrigeration	Total time	Person responsible	Comments

For a more detailed information on the 2-hour/4-hour rule, please refer to the ‘Guidance on the 2-hour/4-hour rule’ document on the NSW Food Authority’s website.

Appendix 4. Temperature calibration and measurement

Calibration procedures

Hand-held thermometers should be calibrated monthly, and results recorded on a checklist.

Ice Point (0°C)

1. Fill a small container with crushed ice.
2. Add a little water to the container to make an ice slurry.
3. Place the thermometer in the centre of the container so that the point of the probe is in contact with the ice.
4. Allow the temperature reading of the thermometer to reach a steady reading.
5. Record the reading and calculate the difference from 0°C.
6. Thermometers with a deviation of more than 1°C should be discarded.

Boiling Water Point (100°C)

1. Fill a small container with boiling water.
2. Immediately place the thermometer in the centre of the container so that the point of the probe is in the centre.
3. Allow the temperature reading of the thermometer to reach a steady reading.
4. Record the reading and calculate the difference from 100°C.
5. Thermometers with a deviation of more than 1°C should be discarded.

More information

- Visit foodauthority.nsw.gov.au
- Email food.contact@dpi.nsw.gov.au
- Phone 1300 552 406