



Food
Authority

Listeria and pregnancy

The foods you should avoid and why

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For further details, you can visit the pregnancy portal on the Authority's website at:
www.foodauthority.nsw.gov.au/pregnancy

Or phone the Food Authority's Helpline on 1300 552 406

1. Background and context

The NSW Food Authority provides general advice to pregnant women on eating during pregnancy, including the importance of eating a healthy diet and foods to avoid.

The Authority often receives enquiries from pregnant women asking why we list certain foods as 'foods to avoid'. The reason is that these foods are regarded as having a higher risk of containing the bacteria *Listeria monocytogenes* which can be harmful to pregnant women and their baby or other bacteria such as *Salmonella*, which also causes food poisoning.

The common foods we advise women to avoid during pregnancy are:

- soft and semi-soft cheeses
- cold pressed meats
- cold cooked chicken
- pre-prepared vegetables and salads
- pre-cut fruit
- pâté
- soft-serve ice-cream
- raw seafood

Pregnant women are at a higher risk of becoming infected with *Listeria* than an average healthy adult, and the outcomes for their baby can be fatal.

During pregnancy, hormonal changes in the body, such as escalated production of progesterone, lower the immune system which can make it harder to fight off illness and infections. *Listeria* can take advantage of this and cause the invasive listeriosis infection, with about one in ten listeriosis cases (10%) in Australia occurring in pregnant women. The risk of infection seems to be highest in the third trimester. It is important to note that while listeriosis can be a very severe illness, the number of cases reported in Australia each year is relatively rare, with around 65 total cases reported to health departments each year. Cases may be rare, but the consequences are dire, with 1 in 5 cases (20%) of listeriosis in pregnant women being fatal for the developing foetus.

The Authority provides information about how best to enjoy foods safely, what foods to avoid during pregnancy and provides alternatives to foods identified as having a higher risk of containing certain bacteria that could be harmful to pregnant women and their unborn babies.

For this reason our main advice is to avoid refrigerated, ready-to-eat foods that may have been stored for long periods and look to consume freshly prepared foods wherever possible. The Authority provides information on *Listeria* to pregnant women to allow them to make an informed food choice regarding the risk and how to minimise it.

In this document, we put the risks in context and explain the science behind the Authority's recommendations on why you should avoid certain foods.

We want you to have the right information so you can make informed, sensible choices about what you eat during pregnancy.

2. *Listeria* and what it can do to your baby

Listeria monocytogenes is a type of bacteria occasionally found in some foods which can cause a rare but dangerous infection called listeriosis. This infection can be especially serious for pregnant women because if *Listeria* is transmitted to your unborn baby it can lead to extremely serious complications including miscarriage, premature labour, or stillbirth.

Listeria monocytogenes is one of ten different types of bacteria within the *Listeria* group, but as it is the only one that infects people, we commonly just refer to it as *Listeria*. The bacteria naturally occurs in the environment (such as in soil) and can then be transferred into food production facilities through things such as people's shoes, crates, pallets, trolleys and forklifts where it can survive in cold, moist locations. Once in a food factory it can get into hard to reach areas and is very difficult to eliminate (the same *Listeria* has been isolated from the one overseas ice cream factory over a 7 year period). Because of this, it is inevitable that *Listeria* may contaminate some food from time to time.

The NSW Food Authority advises some foods to avoid during pregnancy, because these foods are regarded as having a higher risk of containing the *Listeria* bacteria. The risk factors include foods that:

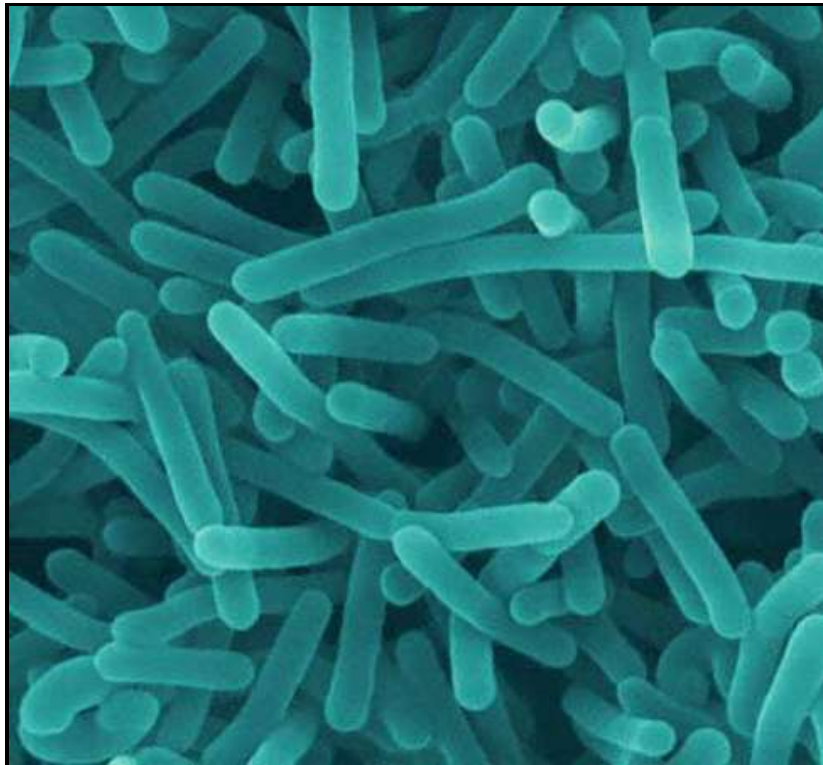
- are ready-to-eat (RTE, consumed without further processing), and
- are processed by slicing, chopping or shredding after cooking, and
- rely on refrigeration temperatures to keep them safe and delay spoilage, and
- there are no other controlling factors such as preservatives, pH, salt, sugar or dried foods, and
- have a shelf life of greater than five days

The foods of most concern for *L. monocytogenes* contamination are those that are stored at refrigeration temperatures for a long period, thereby enabling contaminating *Listeria* opportunity to grow.

Even with these "higher risk" foods, the bacteria may only be present 1-2% of the time, and usually at very low levels that are unlikely to infect anybody. As a result, the number of listeriosis cases in Australia is quite low. However, if these foods are handled poorly and allowed to sit at room temperature then the bacteria can grow to a number that could make someone sick.

While the risk from *Listeria* is important to keep in mind, there are some simple steps you can take during pregnancy to minimise the risk. It is also very critical that you eat a nutritious diet to help your developing baby to grow, to keep you healthy while you're pregnant and help achieve a healthy weight gain (NSW Ministry of Health, 2012).

Cells of *Listeria monocytogenes*



Source: <http://www.listeriablog.com>

2.1 Why is *Listeria* such a problem in some foods?

Scientists only became aware of *Listeria's* ability to infect people through contaminated food during the 1980's when it caused large foodborne illness outbreaks in Switzerland and the USA due to cheeses made from unpasteurised milk. One of the major concerns with *Listeria*, as opposed to most other food poisoning bacteria, is that it is able to grow at refrigeration temperatures. We normally refrigerate foods to stop them spoiling and this also has the benefit of stopping most bacteria that cause food poisoning from growing in numbers. However, *Listeria* can grow (albeit grow very slowly) even in food stored in the fridge.

There are certain foods which are at a higher risk of becoming contaminated with *Listeria* due to the way they are processed, or the extensive handling they undergo. This is particularly the case for foods that are sliced, cut, diced or shredded during processing.

Normally if food does become contaminated with *Listeria*, it is with very low numbers of bacteria that are unlikely to make most people sick. Some scientists think we consume foods containing small numbers of *Listeria* on a regular basis without any effects at all.

The problems arise when the bacteria is given an opportunity to grow to large numbers that can make people sick. This is more likely to occur in foods with a long shelf life of greater than seven days and foods where there are no other controlling factors such as preservatives. These higher risk foods, even when they've been stored correctly, may allow *Listeria* to grow, so the best way to avoid the risk of listeriosis is to avoid these foods as much as possible during pregnancy.

Higher risk foods to avoid if possible (unless cooked thoroughly and eaten while hot)

- Cold cooked chicken
- Cold processed meats
- Soft and semi-soft cheese
- Unpasteurised milk and dairy products
- Raw seafood and cold smoked salmon
- Pre-prepared or pre-packed cold salads
- Pâté
- Raw eggs – due to risk from another bacteria called *Salmonella*

Safer alternatives

- Freshly cooked meat, chicken, seafood that is steaming hot
- Hard cheeses and pasteurised dairy products
- Canned foods
- Freshly washed and prepared fruit, vegetables and salads
- Eggs cooked so the yolk begins to thicken

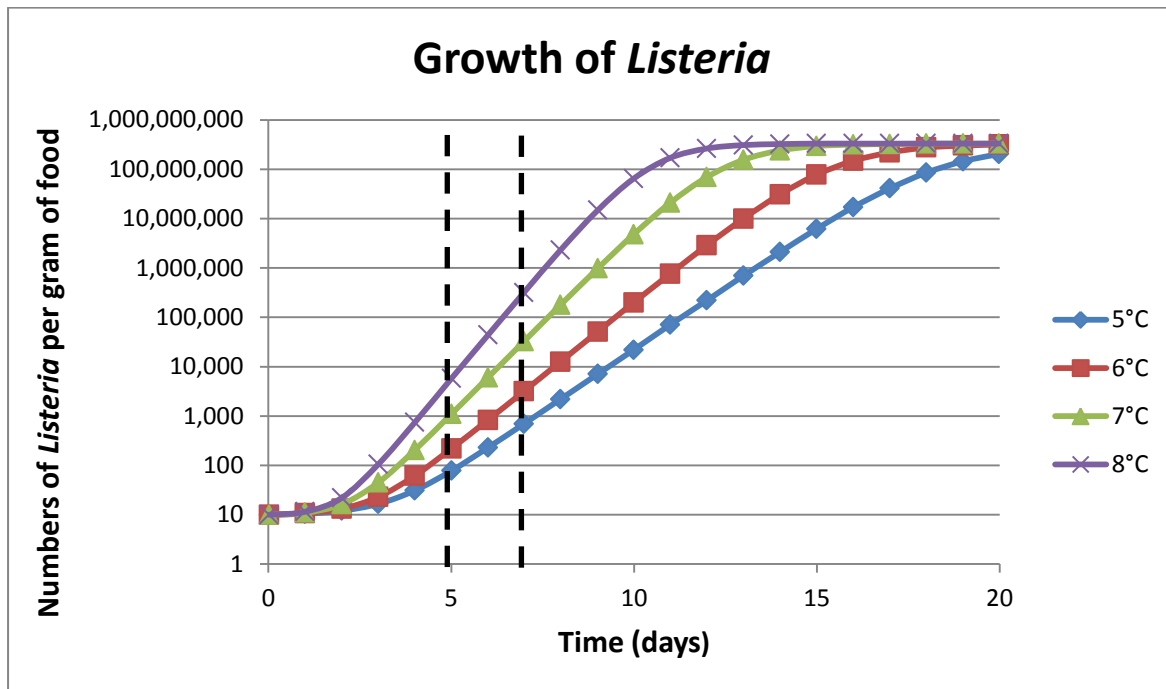
The fact that *Listeria* is quite often present in food is not concerning and you can be reassured that it rarely causes illness. Almost all cases of listeriosis infection are due to someone consuming very high levels of the bacteria in a food. Fortunately, in the vast majority of cases, when *Listeria* accidentally contaminates food it is at very low levels, less than 10 bacteria per gram of food. But over time, if the food provides the right environment, the organism can multiply slowly in the refrigerator to end up with high numbers – this is what you need to avoid. The graph below shows how *Listeria* can grow when conditions are ideal. A few degrees difference in the refrigerator can make a huge difference to the growth rate of the *Listeria* bacterium and therefore the overall numbers in the food.

Over 5 days, the slight temperature difference between 5°C and 8°C can mean a large difference in the number of *Listeria* cells potentially present in the food - 80 cells of *Listeria* at 5°C and 6,000 cells of *Listeria* at 8°C. After 7 days, the difference becomes 700 cells at 5°C and 300,000 at 8°C.

What this means for you is that in order to reduce the risk from *Listeria* in any of the higher risk foods that you buy:

- keep your food as cold as possible in the fridge (at or below 5°C)
- and consume the food within a short period of time (ideally 2-3 days)

Multiplication of *Listeria* under ideal conditions¹



Growth of *Listeria monocytogenes* generated from ComBase predictive models (www.combase.cc)

2.2 About the listeriosis infection

By looking at previous cases of listeriosis, it has become obvious that *Listeria* is quite selective in the people it affects. It tends to infect people who have a lower immune system than the 'normal' healthy adult, primarily affecting:

- people with an underlying illness (through some underlying disease or condition disrupting the immune system)
- people over 65 years of age
- pregnant women and their developing baby

Pregnant women are up to 13 times more likely to get listeriosis from a contaminated food than an 'average' healthy adult with no underlying illness

Listeria is also unusual in that it can cause two different types of illness, a less severe gastroenteritis which can affect healthy people (also called non-invasive listeriosis), but also a

¹ Ideal conditions have been defined as pH = 7 and water activity = 0.995

more severe illness (invasive listeriosis) where the infection can cause very severe complications in people with a lowered immune system.

When you're pregnant, hormonal changes in your body, such as increased production of progesterone, lower your immune system which can make it harder to fight off illness and infections. *Listeria* can take advantage of this and cause the invasive listeriosis infection, with about one in six listeriosis cases (17%) in Australia occurring in pregnant women. The risk of infection seems to be highest in the third trimester.

It has been estimated by the Centers for Diseases Control and Prevention (CDC) in the USA that pregnant women may be up to 13 times more susceptible to listeriosis infection than a normal healthy adult.

Other underlying conditions which have made people more susceptible to a listeriosis infection include cancer, alcoholism and diabetes. A high mortality rate of approximately 30% is associated with the invasive form of the listeriosis infection, and it appears elderly people with underlying conditions such as cancer are the ones who are most often severely affected.

3. Numbers of people who get sick from listeriosis each year

It is important to note that while listeriosis can be a very severe illness, the number of cases reported in Australia each year is relatively rare, with around 60 total cases reported to health departments each year. The number of pregnant women infected with listeriosis each year is even lower. Since 2001 there have been between one and 14 confirmed cases each year, and in comparison to the 301,617 births registered in Australia, demonstrates how rare listeriosis is². Especially when compared to something like sudden unexpected death in infants (SUDI³) where, according to Australian Bureau of Statistics there 136 cases in 2010 and 125 cases in 2011.

Previously it was thought that pregnant women may account for half the listeriosis cases each year in Australia, but now it is much less. This may be due to the messages targeting pregnant women to avoid the higher risk foods being successful and the food industry's effort to minimise contamination of high risk foods.

Unfortunately the outcome of listeriosis in pregnant women can be quite severe, and tragically there have been 14 deaths reported for unborn or newborn babies in Australia between 2001 and 2010 – equating to 1 in 5 cases of listeriosis in pregnant women being fatal for the developing baby.

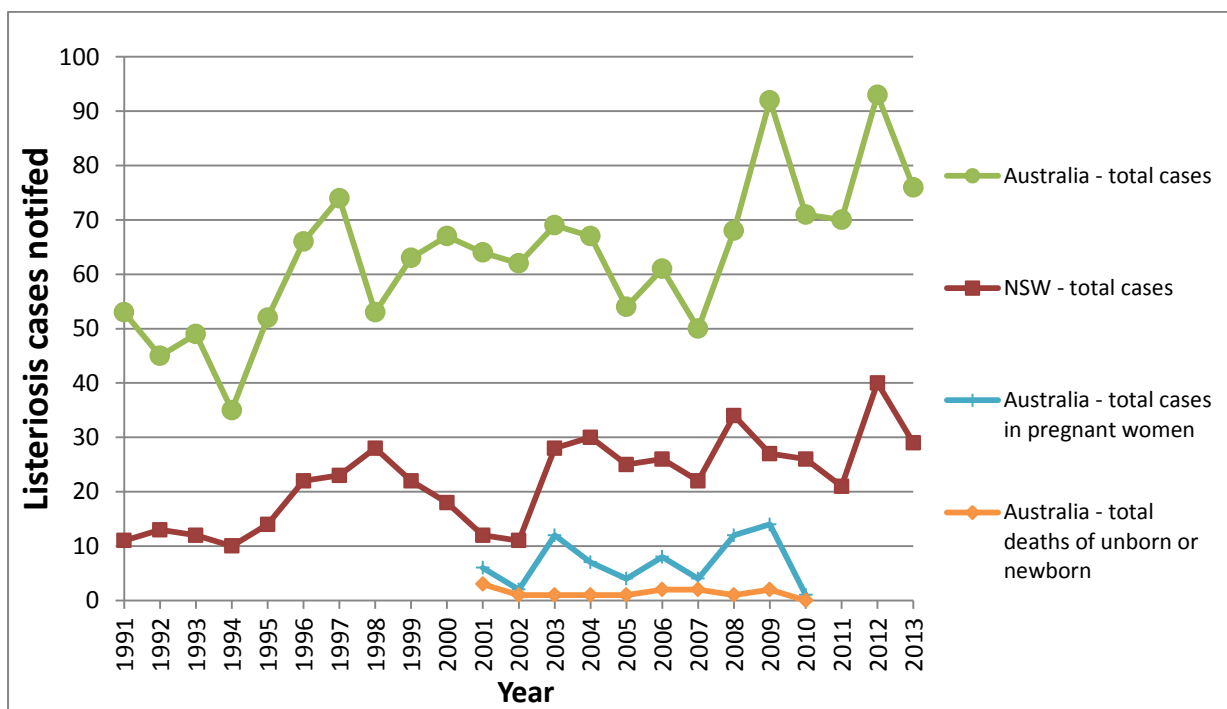
This is why food agencies provide advice to pregnant women, so they avoid the risks and make the best choices on what they eat.

² In NSW the average total number of listeriosis cases is around 20 per year which equates to 3 cases per million people in the population.

³ Ill-defined and unknown causes of mortality (under 1 year of age)

Infection from Listeria is rare
There is an average of 7 cases of listeriosis reported in Australian pregnant women each year, compared with 300,000 births

Number of listeriosis cases notified in Australia each year



Adapted from OzFoodNet reports 2001-2010 and Department of Health and Aging (2013) - National Notifiable Disease Surveillance System (NNDSS)

3.1 The symptoms of listeriosis

In pregnant women, listeriosis may have no symptoms at all, or the symptoms may be very general and include flu-like symptoms such as fever, chills, muscle aches, nausea, and sometimes diarrhoea. The symptoms can take a few days or even up to six weeks to appear. One scientific study of pregnancy-associated listeriosis cases found the incubation period (time between eating the food and the infection occurring) to range from 17 to 67 days (Goulet et al, 2013). If a listeriosis infection is severe and spreads to your nervous system, it can cause headaches, stiff neck, confusion, loss of balance, or convulsions.

In very extreme cases the listeriosis infection can spread to your developing baby, leading to complications such as septicaemia, meningitis, miscarriage, stillbirth, premature labour, the delivery of a low-birth-weight infant, a wide range of health problems for a newborn, or in the most severe cases, infant death.

If you think you may have eaten a contaminated food while pregnant (such as a food recalled for the presence of *Listeria*), you should see a doctor immediately. A doctor may perform a test to see if you have the infection. Your doctor can prescribe antibiotics that are safe to use during pregnancy which can prevent infection of the foetus or newborn.

3.2 Level of *Listeria* bacteria it takes to make someone sick

It is not absolutely certain what level of *Listeria* it takes to make someone sick, as one person (with different underlying conditions) can be more or less vulnerable to infection with *Listeria* than another person.

Because of this uncertainty (and the fact that little was known about *Listeria* at the time) the food legislation has traditionally taken a conservative view. As such, the *Australia New Zealand Food Standards Code* requires *Listeria* to be 'not detected' in certain foods and this will result in a consumer level recall if the bacteria is detected in food.

As it is very difficult to ensure that food is completely *Listeria* free all the time, this can pose some challenges for the food industry. Companies are required to recall products containing listeria, and sometimes they are due to very small numbers of *Listeria*, less than 10 bacteria per gram of food. It is likely that we consume these sorts of levels on a regular basis with no effect to our health.

Scientific data has consistently shown that the risk of listeriosis is increased in ready-to-eat (RTE) foods which support the growth of *Listeria* and have long shelf lives – the opportunity and time for the organism to grow to high levels. Data also shows that cases of listeriosis most often result from very high levels of *Listeria* in the food (FAO/WHO, 2004; FDA & USDA, 2003). This is shown in the table below where it was estimated that more than 96% of listeriosis cases are due to doses greater than 100,000 *Listeria*/serve – which occurs in approximately 0.03% of meals (once every 3,000 meals). Even then, it is now thought that not all *Listeria monocytogenes* may have the same ability to infect people.

Estimations for what level of *Listeria* it takes to get sick

Number of <i>Listeria</i> cells consumed in a food	How often this number is consumed in a meal (% servings annually)	% of listeriosis cases this number has caused
less than 1	99.18%	0.03%
10	0.43%	0.03%
100	0.21%	0.13
1,000	0.10%	0.60%
10,000	0.05%	2.85%
100,000	0.02%	13.47%
>1,000,000	0.01%	82.89%

Adapted from (FDA & USDA, 2003)

As we get a better understanding of *Listeria* and how it affects people, the science now tells us that a small number of *Listeria* is very unlikely to make someone ill and the infectious dose (the number to make someone ill) is more likely to be in the tens of thousands of bacteria, even for those people highly susceptible to *Listeria*.

An analysis by Buchanan et al (1997) using German food contamination data and information from people that fell ill suggested that the doses of greater than 10,000 *Listeria* were needed to cause illness in susceptible people. The most susceptible people to the invasive listeriosis infection are those whose immune system has been lowered through medication (such as for organ transplants) or disease (cancer, AIDS patients). These severely immunocompromised individuals may be 1000-fold more susceptible than healthy people. Clearly, the combination of the food type, an individual person's susceptibility and variation in strain virulence can lead to enormously different outcomes from a specific dose of *Listeria*.

Most government food regulators internationally now consider that doses of less than 1000 organisms are highly unlikely to cause disease, and this has been reflected in food safety regulations, for example in Canada and in Europe. In Australia, Food Standards Australia New Zealand (FSANZ) are currently reviewing the requirements in the Food Standards Code.

4. Frequency of food containing *Listeria*

Food surveys have been conducted worldwide to find out how often food contains the *Listeria* organism. Surveys conducted by the NSW Food Authority and other governments around Australia show that in most cases around 1-2% of food may contain *Listeria* at any one time – usually at very low levels. Different foods may be contaminated at different rates, depending on how the food is grown or harvested, how it is handled and processed and the length of the shelf life until it is consumed.

Listeria naturally occurs in the environment (such as soil) and can then be transferred through foot traffic, crates, pallets, trolleys and forklifts into food production facilities where it can survive in cold, moist locations. Despite great efforts to eradicate it from factories, *Listeria* can become endemic in the factory environment (the organism has been isolated from the same overseas ice cream factory over a 7 year period), it is inevitable that it may contaminate some food from time to time.

In the vast majority of cases, if *Listeria* does find its way into a food it does so at only very low numbers which are unlikely to cause anyone to be sick. The highest risk food processing operation is slicing or shredding, as the equipment used to do this can be very difficult to clean and *Listeria* can hide in the hard to reach areas in this machinery.

The nature of the food industry now, with foods having longer shelf lives and a complex distribution chain means that *Listeria* is now more of a problem in foods than it was for previous generations.

5. How can you best manage the risk from *Listeria*

Firstly, the most important thing for the health of your developing baby is to eat a balanced, healthy and nutritious diet. The best way to meet you and your baby's nutritional needs is to eat a wide variety of nutritious foods and be as healthy as possible as early as possible.

The best way to minimise the risk from *Listeria* is to totally avoid foods that are more likely to contain *Listeria* for the duration of your pregnancy. These include:

- processed ready-to-eat meats and chicken
- soft cheeses
- refrigerated pate and meat pastes
- pre-cut fruit, pre-packaged salads and unpasteurised juices
- cold smoked seafood and pre-cooked prawns
- raw seafood, including oysters and sushi
- seed sprouts
- soft serve ice cream

But in everyday life there are going to be occasions where you have very little choice or may accidentally consume one of these foods. It is important not to stress yourself about what foods to eat – because this isn't good for your baby either - but just try to make sensible, informed choices to minimise the chance that you might eat a food containing *Listeria*.

In the same way that every time you drive a car there is a risk of an accident, to totally eliminate the risk you would never drive anywhere. But since this is impractical, you minimise the risk by wearing a seatbelt, driving to the speed limit and keeping your car mechanically sound. By minimising the risk, the actual chance of having a car accident is quite small.

In a similar way, every time you eat a 'high risk' food there is a very small possibility it may contain high levels of *Listeria* but fortunately the actual likelihood is very, very low, so the more often you can avoid these foods, the better.

We do however have some safer alternatives, so you can still enjoy the foods you like while pregnant:

- Sliced deli meats can be safely consumed if they are re-heated until they are steaming hot– this will ensure that any *Listeria* organisms present will be killed off. Cooking whole roast meats and then slicing them yourself is also a safer alternative, provided you eat the leftover within a few days. Fermented salamis usually have a low pH which means that *Listeria* cannot grow and may actually die off during the shelf life of the product.
- Hard cheeses like Cheddar and Parmesan are quite acidic so the harsh environment means that if any *Listeria* organisms are present, they will actually die off during the shelf life. Soft cheeses included in fully cooked products are safe to eat.
- Pâté, meat or fish pastes that are packaged in cans or pouches that do not require refrigeration (eg shelf stable). These types of products are considered safe, as they would have been cooked at higher temperature that would ensure they are commercially sterile and as such, *Listeria* would not be present in these products.
- Purchase whole melons and clean the skin before cutting – this makes sure that any potential contamination on the skin is removed. Prepare your own fresh cut fruit at home, rather than purchasing pre-cut fruit at a shop. Consume fresh fruit and vegetables, or else canned or frozen varieties.
- Pasteurised juices are heated to a temperature that will ensure that any food poisoning bacteria, including *Listeria*, are destroyed. Pasteurised juices are very safe to consume.

- Smoked seafood and cooked crustaceans can be made completely safe by including in fully cooked dishes.
- Consume freshly prepared sushi that only contains freshly cooked ingredients.
- Cook seed sprouts (alfalfa, radish etc) then they are safe to eat.
- Instead of soft serve ice-cream, eat hard frozen ice cream or gelato.

6. Why there are certain 'foods to avoid' for pregnant women and the risk

The reasons there are certain foods to avoid, are outlined in this section. Essentially, all of these foods have a higher risk of allowing the *Listeria* organism to contaminate the product and multiply.

6.1 Processed (sliced, diced and shredded) ready-to-eat deli meats & chicken

The risk

Studies overseas and within Australia tend to suggest that one of the highest risk food groups for listeriosis are pre-sliced deli meats and ready-to-eat (RTE) chicken and poultry. Due to the additional handling these foods go through, they are more likely to be contaminated with *Listeria* than other foods. Slicing, dicing and shredding of RTE meat products are high risk operations for contamination of these products with *Listeria*, as it likes to live in the small hard to reach areas of this type of equipment particularly where there is a bit of moisture and food particles.

An Australian study estimated that RTE processed luncheon meats⁴ may be contaminated with *Listeria* at a rate of 4.7% and be responsible for up to 40% of human cases of listeriosis in Australia each year (Ross, Rasmussen, Fazil, Paoli, & Sumner, 2009).

A study in the USA ranked deli meats as the highest risk food of the 23 RTE foods examined (FDA & USDA, 2003). It was estimated that deli meats caused approximately 90% of listeriosis cases in that country and were responsible for almost 1600 cases per year.

In the last few years, new requirements have been implemented for the meat industry such as the implementation of a *Listeria management program* for processors of RTE meats (NSW Food Authority, 2008). While this does not provide any guarantee that the product will be free of *Listeria*, it should ensure that the rate and level of any contamination is minimised.

The Authority conducted a survey from March 2011 to December 2012 sampling a total of 303 sliced/diced, pre-packaged RTE meats from supermarkets, green grocers and delicatessens across Sydney (NSW Food Authority, 2013). Samples included processed chicken and turkey, slow cured meat, cooked cured meat and cooked/uncooked fermented meats. Of the 303

⁴ Luncheon products were defined as those that might be served sliced or shaved as part of a salad or included in a sandwich, including emulsified products, hams, whole cooked muscle meats, non-fermented sausages not intended for re-heating

samples tested, *L. monocytogenes* was detected in two samples (0.7%), both at the level of 10 cfu/g (limit of detection). These results indicate that manufacturers are working hard to keep the organism out of their products.

Several studies in the USA have examined the risk of listeriosis from pre-packaged deli meats compared to meats sliced at retail (eg in delicatessens, cafés or in supermarkets) (Endrikat et al., 2010; Pradhan et al., 2009) and found meats sliced at a retail shop to be a higher risk of contamination. The additional handling at retail level to do the slicing was proposed as one of the reasons for this finding and the difficulty in cleaning slicing machines.

Safer alternatives

Sliced deli meats can be safely consumed if they are re-heated until they are steaming hot (to 75 degrees) – this will ensure that if any *Listeria* are present they will be killed off.

The smallgoods industry is also now starting to use some antimicrobials that are effective against *Listeria* such as sodium lactate (325), potassium lactate (326), potassium diacetate (261) and sodium diacetate (262). The addition of these preservatives has been shown to decrease the risk by stopping or slowing the growth of *Listeria*, should it contaminate the product.

Cooking whole roast meats and then slicing them yourself is also a safer alternative, provided you eat the leftover within a few days.

Fermented salamis usually have a low pH which means that *Listeria* cannot grow and may actually die off during the shelf life of the product.

6.2 Soft cheeses

The risk

Soft cheeses such as Brie, Camembert, Fetta and Ricotta make it onto this list because they are exposed during the manufacturing process, increasing the chance of contamination by *Listeria*, and the pH (measure of acidity) of the cheese is quite high, allowing *Listeria* to grow during the shelf life of the product if it is there.

While all cheese made in Australia is made from milk that has been pasteurised (a heating process that will kill off *Listeria*) there is potential for re-contamination during the maturation period which may be 10-12 days, and then for growth of the organism to occur during the shelf life of the product which may be up to a few months.

Until late 2012, there was little evidence to show that Australian cheeses were very risky, because all are made with pasteurised milk. However in 2012 a brand of soft cheese was implicated in several cases of listeriosis across the country, including one miscarriage at 19 weeks.

Safer alternatives

A safe alternative is hard cheeses like Cheddar and Parmesan. These products are actually quite acidic so the harsh environment means that if any *Listeria* organisms were present, they will actually die off during the shelf life.

Soft cheeses included in fully cooked products are safe to eat.

6.3 Refrigerated pâté and meat pastes

The risk

A risk assessment study done in the USA ranked pâté and meat spreads as third highest in terms of risk per serve (FDA & USDA, 2003), estimated to cause around 4 cases of listeriosis per year. This reflects the fact that foods in this category are eaten relatively infrequently and in relatively small amounts, so the likelihood of someone consuming enough *Listeria* to make them ill is quite small.

In Australia, the risk from pâté was examined by Ross et al. (2009) who estimated the contamination rate of these products with *Listeria* was 1.2% and predicted to cause a case of listeriosis once every 3 years. This study considered pâté production where the product is fully cooked but requires refrigeration. The risk occurs at the point between cooking and packaging, where there may potentially be opportunities for *Listeria* to contaminate the product.

Safer alternatives

The safer alternatives are pâté, meat or fish pastes that are packaged in cans or pouches that do not require refrigeration (eg shelf stable). These types of products are considered safe, as they would have been cooked at higher temperature that would ensure they are commercially sterile and as such, *Listeria* would not be present in these products.

6.4 Pre-cut fruit, pre-packaged salads and unpasteurised juices

Rockmelons (cantaloupe) that have been cut have caused cases of listeriosis – make sure you clean the skin before cutting and avoid unpasteurised juice.

The risk

Fresh fruit and vegetables form a very important part of a healthy nutritious diet and you should ensure that you include plenty of these. The best precaution is to wash them under running water before you eat them and throw away any dirty or badly bruised fruit.

However, there have been outbreaks of listeriosis due to rockmelons that have been cut and then stored at room temperature for extended periods of time. There have been several outbreaks overseas and some within Australia so it is best to avoid any pre-prepared fruit salads that contain rockmelon. Other pre-cut fruit may also carry some risk because of the additional handling and processing that it undergoes – much like the sliced meats.

Pre-packaged salads have been regarded as a high risk food, because the shelf life is a little longer than unpackaged vegetables and it was thought this might present an opportunity for *Listeria* to grow. However, this is a broad, diverse product range and many of the wet salads contain a dressing that is quite acidic so this acts as a preservative. The risk assessment work conducted in the US actually ranked deli-type salads as low risk as it was considered that the bacteria did not grow in many of these products. Because there are such a diverse range of pre-packaged salads where *Listeria* may, or may not grow, the general advice tends to be to avoid them.

Juices that are fresh squeezed and sold by the glass, at some juice bars, for example, may not be pasteurised (heat-treated) or otherwise treated to ensure their safety. You should avoid all unpasteurised juices as a precaution.

Safer alternatives

Purchase whole melons and clean the skin before cutting – this makes sure that any potential contamination on the skin is removed. Prepare your own fresh cut fruit at home, rather than purchasing pre-cut fruit at a shop.

Consume fresh fruit and vegetables, or else canned or frozen varieties.

Pasteurised juices are heated to a temperature that will ensure that any food poisoning bacteria, including *Listeria*, are destroyed. Pasteurised juices are very safe to consume.

6.5 Cold-smoked seafood and pre-cooked prawns

The risk

In 2002, Food Standards Australia New Zealand (FSANZ) examined the risk posed by cooked crustacean and cold-smoked salmon (FSANZ, 2002).

The findings of the study were that smoked seafood such as cold-smoked salmon poses a significant public health risk for people susceptible to listeriosis. There is potential for smoked salmon to be contaminated with *Listeria* and the cold smoking process does not deliver a “kill-step”. Therefore *Listeria* is able to survive and can grow during the shelf life of the product, which can be four to six weeks to reach such levels that may pose a risk to public health and safety. Although smoked seafood is not normally consumed in large amounts, the contamination rates have been reported to be high. The risk assessment concluded that the main management strategy for cold-smoked seafood was to educate consumers about the risk.

For cooked crustaceans (such as prawns), the conclusion from FSANZ was that there was a potential risk, however it was considered less risky than cold-smoked salmon. The cooking step should eliminate *Listeria* however there is potential for it to become contaminated after cooking. What made cooked prawns safer was that the shelf life is short giving limited time for *Listeria* growth to occur before the prawns spoil.

Safer alternatives

Smoked seafood and cooked crustacean can be made completely safe by including in fully cooked dishes.

6.6 Raw seafood including oysters & sushi

The risk

Oysters are filter feeders and tend to accumulate and concentrate any bacteria or viruses that occur in the water. There has been a history of oysters causing foodborne illness in the past in Australia and a number of control measures have been implemented to limit the risk. However, oysters are still considered a high risk food and should be avoided during pregnancy.

Products made with raw fish (such as sushi or sashimi) are more likely to contain parasites or bacteria than foods made from cooked fish. The NSW Food Authority has done several surveys of sushi and found the microbiological status to be similar to other high risk foods (ISC, 2008; NSW Food Authority, 2009). In the 2008 national survey of sushi, 13 of 446

(2.9%) samples were found to contain *Listeria* in the winter months, while during the summer 13 of 404 (3.2%) samples were found to contain *Listeria*. In a follow-up survey conducted in NSW, *Listeria* was found in 3 of 55 (5.2%) samples.

Although *Listeria* has been found in some sushi samples, the short shelf life of the product means that it should be okay – however – many sushi stores display their sushi at, or near, room temperature which may allow *Listeria* to grow quickly. Therefore, it remains advisable to avoid eating sushi products, in particular pre-made sushi.

Safer alternatives

If you are a sushi fan, the safer alternative is to consume freshly prepared sushi that only contains freshly cooked ingredients.

6.7 Seed sprouts

The risk

Raw sprouts of any kind (including alfalfa, clover, and radish) are considered a high risk food, not just for *Listeria* but for other food poisoning bacteria such as *Salmonella* and *E. coli*. The reason for this is that bacteria can get into the seeds used to produce the sprouts. Once bacteria enter the seed through cracks in the shell, they are very difficult to eliminate. The conditions used to grow sprouts are also very conducive to the growth of food poisoning bacteria.

Sprout manufacturers in NSW are required to take extra precautions such as testing the batches of seed they receive and testing the water used to irrigate the seeds as they are sprouting. However, because seed sprouts are a raw product there is some possibility of pathogens surviving the process.

Check sandwiches and salads as they may often contain raw sprouts. Request that raw sprouts not be added to your food, such as sandwiches.

Safer alternatives

If seed sprouts are cooked then they are safe to eat.

6.8 Soft serve ice cream

The risk

Soft serve ice cream has historically been placed on the list of high risk foods to avoid by the Authority because *Listeria* has been detected in past surveys of soft serve ice cream. However, there have not been any reports linking soft serve ice cream to any cases of listeriosis in Australia.

Soft serve ice cream is typically kept at refrigeration temperature (0-5°C), unlike hard ice cream which is stored frozen stopping any bacteria from growing. Ice cream is high in moisture and protein content and *Listeria* could grow slowly at these temperatures.

The presence of *Listeria* was most likely due to poor hygiene and cleaning of the soft serve dispensing machines, which can lead to the organism contaminating the machine. More recently, the safety of soft serve ice cream has improved due to a number of factors such as:

- distribution of pre-mix in powdered form and
- self-pasteurising machines have been introduced in the many of the major fast food chains. Each night the machine heats up to a temperature hot enough to kill any bacteria that may be present in the holding tank.

The main cause of the problem with older machines is poor maintenance. Thorough cleaning, with an effective sanitiser and regular maintenance are the main preventative controls for contamination of soft serve. If you have a craving for a soft serve ice cream or a thickshake, take a peek at the dispensing machine to see how clean it really is.

The Authority is doing a survey of soft serve ice cream to get some updated data on whether soft serve still represents a high risk food for *Listeria*, however, until the results of this survey are known, it is advisable to avoid soft serve.

Safer alternatives

Hard frozen ice cream and gelato is considered safe as *Listeria* cannot grow in a frozen product. Soft serve yoghurt should be a safer alternative because of the acidity of the product not allowing *Listeria* to grow.

7. Other foods and risks

Aside from the risk of *Listeria* there is some general food safety advice you should also follow when pregnant. *Salmonella* is another bacteria that can be present in food. People infected with *Salmonella* commonly develop headache, fever, stomach cramps, diarrhoea, nausea, and vomiting. Symptoms often start 6-72 hours after infection and can usually last for 4-7 days, sometimes much longer. Pregnant women are not at an increased risk of contracting salmonellosis, but in rare cases it may trigger miscarriage.

7.1 Eating out

Eating at a restaurant, cafeteria, or a fast food outlet can be an enjoyable experience and if you take some sensible precautions you can continue to enjoy eating out while you are pregnant. The difference with eating out is that you don't know the history of the food or who is preparing it.

When you eat out, look at your surroundings before you even sit down. If it's not clean, you should consider eating somewhere else. If the areas you can see aren't clean, then you have to wonder about the cleanliness of the food preparation areas that you can't see.

When eating food you haven't prepared yourself, it is even more important to:

- avoid the 'high risk' foods
- avoid food that is lukewarm
- avoid food that looks like it has been stored for several days (eg pre-made and pre-packaged salads, sandwiches and wraps)
- request that food can be freshly cooked
- not eat food if you are uncertain about how it has been prepared and stored

A lot of takeaway food is cooked and then stored in a bain marie or under warming lights until it is purchased. It is wise to avoid this type of food and instead ask for freshly cooked foods.

Always request that your food be cooked thoroughly, especially meat, poultry, fish, and eggs. When a hot meal is served, make sure it's piping hot and thoroughly cooked. If it's lukewarm or appears under-cooked (eg your burger is pink inside), then send it back.

When dining out, remember that harmful bacteria can be hidden in some foods on the menu, so pay close attention to the type of food it is and how it's prepared. If you're unsure about the ingredients in a particular dish, ask your server before ordering it.

Salmonella can be found in raw or undercooked eggs. Some restaurants may use uncooked eggs in foods like Caesar salad dressing, custards, and some sauces such as aioli. To avoid the risk of food poisoning from *Salmonella* it is best to avoid foods that might contain raw or undercooked eggs.

7.2 Salad bars and smorgasbords

Because you don't know the history of the food on display, who has handled it and whether it has been refrigerated the entire time, the Authority's advice is to avoid salad bars and smorgasbords where possible. If there is no other choice than to eat from a smorgasbord, it is best to choose from the hot food only. By being careful when eating out, you can reduce the risk of eating foods that may be contaminated with *Listeria*.

7.3 Leftovers

To avoid food poisoning (not just the risk from *Listeria*) it is important to handle leftovers with care. If you take a doggy bag home from the restaurant and you won't be arriving home within two hours of the food being served, don't take the leftovers home with you. And, remember that the inside of a car can get very warm, and bacteria can grow rapidly in foods if they're left in these conditions. To be safe, it's best to go directly home after eating out and put your leftovers in the refrigerator as soon as you arrive.

When hot, cooked food is purchased, get the food home quickly and eat it right away. Don't let it sit out at room temperature. Cold foods should be eaten within two hours of preparation. Otherwise, store it in the refrigerator or freeze it for eating at another time.

Leftovers of cooked foods are considered fine and can be eaten if they are refrigerated promptly and used within a day or two.

8. Balancing the risks

Keeping the risk from *Listeria* in context is important. Although it can have a devastating outcome, the number of reported cases each year is quite low. It is very important for your developing baby to eat a healthy nutritious diet.

Pregnant women are at a higher risk of becoming infected with *Listeria* than your average healthy adult, and the outcomes for your baby can be bad. However, the risk should be kept in context and you should make sensible choices in the food you eat, rather than stressing – which could be worse for the development of your baby.

The guidance regarding safe food and listeriosis is only while pregnant, and once the baby is born, there is no reason to restrict the diet any longer as there is no evidence that *Listeria* can be passed through breastfeeding.

The risk of acquiring listeriosis is low and the benefits from enjoying a balanced, healthy diet outweigh the risks. The Authority maintains a segment on its website dedicated to pregnancy and food safety. The Authority provides information about how best to enjoy foods safely, what foods to avoid during pregnancy and provides alternatives to foods identified as having a higher risk of containing certain bacteria that could be harmful to pregnant women and their unborn babies.

For this reason our main advice is to avoid refrigerated, ready-to-eat foods that may have been stored for long periods and look to consume freshly prepared foods where ever possible.

The Authority provides information on *Listeria* to pregnant women to allow them to make an informed food choice regarding the risk and how to minimise it. It is not to say that every piece of deli meat has *Listeria* organisms on it, but some foods have a higher potential rate of contamination than others, and it is better to avoid them during pregnancy.

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