

Hygiene and foodborne infections

Fact sheet

In addition to health and sustainability, food safety is one of the three central themes of information provided to consumers by the Netherlands Nutrition Centre. A common cause of food-related illness is the consumption of microbiologically contaminated food products. Most of these foodborne infections occur in the home. Thus, in about 40% of foodborne infection clusters reported to the Centre for Infectious Disease Control (CIb), the food preparation site was stated to be 'home'.¹ Consumers must, therefore, focus on food safety when buying, washing, separating, heating and refrigerating food.

Estimates by the National Institute for Public Health and the Environment (RIVM) show that, each year, there are between 600,000 and 700,000 cases of foodborne infections related to contaminated food in the Netherlands. Related symptoms (nausea, vomiting, diarrhoea) usually fade away naturally. To a much lesser extent, foodborne infections can cause serious complications, such as meningitis, acute renal failure (HUS) or neurological disorders such as Guillain-Barré syndrome. Dozens of people die each year due to microbiologically contaminated food.²

This fact sheet underpins the Netherlands Nutrition Centre's recommendations to consumers for preventing foodborne infections. Of prime importance for these recommendations are reports by international bodies such as the World Health Organization (WHO), the European Food Safety Authority (EFSA) and the European Centre for Disease Prevention and Control (ECDC). National bodies such as the Health Council of the Netherlands, the National Institute for Public Health and the Environment, and the Netherlands Food and Consumer Product Safety Authority also play an important part in developing the recommendations.



For whom is it relevant?

The Netherlands Nutrition Centre's recommendations for preventing foodborne infections are relevant to every individual consumer. There is a special focus on the so-called 'YOPIs', which stands for:

- Young (babies and small children up to the age of 5)
- Old (above the age of 65)
- Pregnant women
- Immuno-compromised (people with impaired immune systems, such as those being treated for cancer, kidney disease, rheumatoid arthritis or diabetes).

They are more likely to get ill, due to reduced immunity, too little gastric acid or chronic intestinal problems.

Certain medications, such as immunosuppressants, antibiotics and gastric acid inhibitors, can increase the risk of foodborne infections. There are specific dietary recommendations for pregnant women, to avoid the risk of contamination with *Listeria monocytogenes* and *Toxoplasma gondii*. In cases of pregnancy, these pathogens can cause spontaneous abortion.³

The Netherlands Nutrition Centre's recommendations can be used by healthcare professionals as well as by commercial institutions (such as the retail sector and the food industry) to educate consumers about this issue.

What issues are involved?

The number of consumers affected by foodborne infections varies from year to year. Some types of foodborne infection, such as salmonellosis, are steadily declining. While other infections, such as campylobacteriosis and virus infections, are actually increasing. In recent years, there has also been an increase in the number of hospitalisations and deaths due to gastrointestinal infections.³

There are a number of important trends with regard to foodborne infections:⁴

- Demographic trends. Changes in the composition of the population, such as population ageing, will boost the absolute incidence of infectious diseases of the gastrointestinal tract.
- Globalisation. Different pathogens may occur in other countries. As a result of globalisation, these may be brought in on imported products or by international travellers. This could lead to an increase in cases of disease, some of which might be of a type that is new to the Netherlands.
- Microbial evolution. Pathogens can continuously adapt. The outbreak of EHEC bacteria in Germany, in the spring of 2011, showed that adaptation can give rise to new pathogenic types that are capable of infecting large numbers of people.
- Lifestyle. Aspects such as convenience foods, eating more raw foods, and the need for long-life fresh produce can bring new risks.

Scientific situation

Bacteria, yeasts, moulds and protozoa are all micro-organisms. Some types of micro-organisms that can contaminate food products, and grow on them, are pathogenic. These are known as pathogens. Pathogenic viruses and parasites can also contaminate food products, and thus make people ill. The Netherlands Nutrition Centre's public information describes all pathogenic micro-organisms, viruses and parasites as 'pathogens'.

Antimicrobial resistance

In recent years there has been a worldwide increase in antimicrobial resistance (AMR). While this is a worrying development, it does not mean that we are suddenly at great risk of foodborne infections. If people become infected by foodborne pathogens, such as *Salmonella*, *Campylobacter* or *E. coli*, the symptoms usually fade away naturally. Such cases are not particularly dangerous. Antibiotic therapy is only administered in exceptional cases, where the patient in question belongs to a high-risk group, for example, or if a systemic infection (sepsis) develops. Only in these cases, therefore, it is important to know to which antibiotics the strain is resistant. It is almost impossible for people to avoid coming into contact with antibiotic-resistant bacteria. Sources of infection include the environment or food products (although we do not know the exact contribution of food). However, such risks can be reduced by taking the proper hygiene measures.⁵



Shelf-life expiry date

According to the Commodities Act, a shelf-life expiry date can be indicated in one of two ways:

- The 'best before' date indicates the date beyond which the manufacturer or distributor of the food in question can no longer guarantee the product's integrity and quality.
- The 'use by' date is for highly perishable products that must be stored at a temperature between 0 °C and 6 °C and/or cannot be preserved for more than five days.

It is important for highly perishable products with a 'use by' date to be well refrigerated, and they should not be consumed after the 'use by' date. If a product's 'best before' date has passed, its quality may decline, but this does not necessarily mean that it is unsafe. If the shelf life has been exceeded, there are a range of conceivable scenarios. Stable products, such as canned preserves, dry groceries, and frozen products, pose no microbiological risk if the shelf-life expiry date has been exceeded. However, less stable products, such as refrigerated perishable products, can pose risks if the shelf-life expiry date has been exceeded, so the 'best before' date remains a reliable indication for products of this kind. For some products, such as table salt, there is no mandatory shelf-life expiry date. In the case of unprocessed fresh produce, such as fruit and vegetables, their appearance (i.e. patches of decay) gives a reasonable indication of their microbiological status.⁶

While most bacteria, yeasts or moulds are not pathogenic, they can cause food spoilage by breaking down protein, starch or fat. This often generates an abnormal smell and taste. At this point, the food is unpalatable or inedible. If we were to eat it, however, we would not necessarily become ill. This is because pathogens are either completely absent or are not present in sufficient numbers to be hazardous. On the other hand, pathogens can reach dangerous numbers without changing the properties of the food in question. Alternatively, they can produce toxins that will make you ill. Externally, there are often no clues that such toxins are present, as they cannot be seen, smelled or tasted. If food is stored for too long, or at too high a temperature, some bacteria can produce biogenic amines, such as histamine. In some people, this can trigger an allergic reaction. This is a well-known problem with fish, such as mackerel or tuna, for example.⁴

One way in which pathogens in food can make people ill is by infecting them; the other is by poisoning them. Infections are caused by pathogens entering the gastrointestinal tract and surviving there. These organisms can then multiply there, or elsewhere in the body. The period between exposure and the

onset of disease symptoms (the incubation period) varies from several hours to several months, or even several years in the case of parasites, for example.⁴

In cases of poisoning, the pathogen has multiplied in the food and produced toxin, prior to consumption. Toxin may be produced if food is stored incorrectly (for extended periods of time at room temperature, for example). Heating food prior to consumption will be sufficient to kill the pathogen but, in many cases, it will not inactivate the toxin. Disease symptoms often occur within a few hours of consumption. The classification into infection and poisoning is not fully comprehensive. In addition, the ability of many infectious pathogens to cause disease often depends on the toxins that such bacteria or fungi produce in the body. Such infections are also called toxico-infections. An example of this is *Clostridium perfringens*.⁴

The public information provided by the Netherlands Nutrition Centre uses the term 'foodborne infection', in a general sense, to indicate both foodborne infections and/or cases of food poisoning.

What determines whether you become ill?

Food containing pathogens or their toxins does not always make people ill. Several factors influence the risk of developing a disease as a result of the microbial contamination of food:³

- the type of product eaten (for example, some types of food can increase the pathogen's chances of survival in the stomach, as can the amount of the product that you eat).
- virulence (the pathogenicity of the pathogen in question).
- the number of pathogens ingested with the food.
- the age and physical resistance of the consumer. The so-called YOPIs are more susceptible than most.

Although infections caused by foodborne pathogens are often associated with contaminated food, a substantial percentage of foodborne infections are caused by person-to-person contact and by contamination from the environment. Viruses, in particular, are highly contagious. Thus, practicing good hygiene in the local environment is also an important way of avoiding cross-contamination.³

Which pathogens are relevant?

Many different pathogens can cause foodborne infections. Each year, the RIVM assesses the burden of disease caused by the 14 major pathogens in the Netherlands. This burden of disease is expressed in DALYs (Disability-Adjusted Life Years). The DALY represents the number of healthy years lost due to premature death or to living with a disease. When calculating DALYs, four major aspects of diseases are taken into consideration. These are the number of people suffering from the disease in question, the severity of the disease, the associated mortality, and the age at which such mortality occurs.³

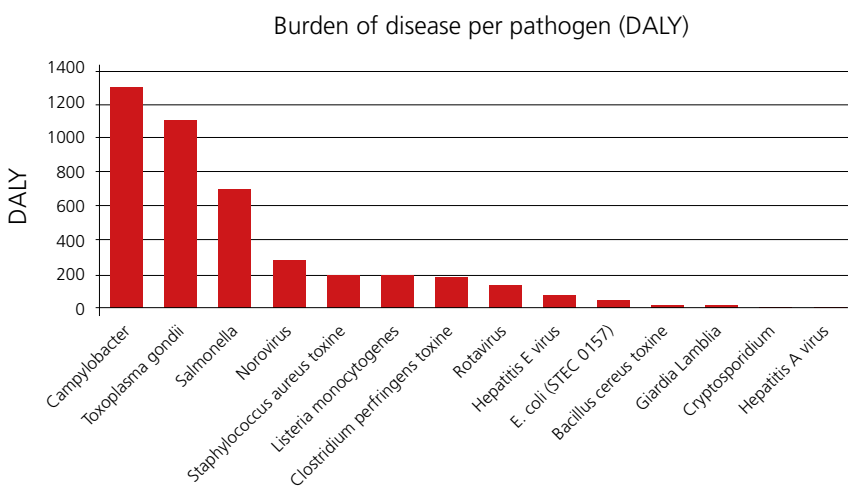


Figure 1: Burden of disease per pathogen caused by contaminated food in the Netherlands in 2017.²

In terms of burden of disease, *Campylobacter* and *Toxoplasma gondii* are at the top of the list. Disease caused by the parasite *Toxoplasma gondii* is not very common, but the burden of disease involved is large as its effects can be serious (for example, stillborn children or serious eye disorders). Noroviruses, rotaviruses and the toxins produced by *Staphylococcus aureus* and *Clostridium perfringens* are the most common causative agents of foodborne infections. However, the burden of disease associated with these groups is lower, as the effects are often milder. *Campylobacter* and *Salmonella* are responsible for most mortality.²

Are we too clean?

There are regular reports that the increased incidence of some allergies or chronic diseases in Western society is due to the fact that we are too clean. This 'hygiene hypothesis' states that this increase is due to reduced exposure to infections in early childhood and to improved hygiene. Although there are some indications, still a great deal of research is needed into the exact mechanism involved and how this affects our immune system. As part of the effort to prevent foodborne infections, there is still a great need for effective hygiene measures, such as hand washing and ensuring that food is prepared in a clean environment.⁷



Risk perception by consumers

The burden of disease caused by foodborne infections is much less than the burden of disease caused by unhealthy dietary patterns. However, it is many times greater than the burden of disease caused by many chemical contaminants, such as pesticide residues or dioxin. Yet consumers judge the risks associated with chemical contaminants (such as pesticide residues, hormones or antibiotics) to be greater than those associated with foodborne infections. There is a clear difference between consumers' perceptions of the food safety risk and the actual risk involved.⁷

Which products are most often contaminated?

Animal products such as meat, eggs, dairy products, fish, crustacean & molluscan shellfish, are the leading causes of foodborne infections in the Netherlands.

Raw animal products, in particular, pose a risk. It appears that consumers are not always aware of the risks involved when eating raw products of this kind.¹

Although animal products cause the greatest burden of disease, the events of the past few years have shown that incidents involving raw fruit and vegetables can also lead to relatively large outbreaks.

Thoroughly washing fruit and vegetables may not

prevent all foodborne infections, but it can help to reduce the risk slightly. Germinated seeds and sprouts, such as bean sprouts, are particularly susceptible to microbial contamination. The specific recommendation in this case is that the product should be heated before consumption.

How can you prevent foodborne infection?

Many cases of foodborne infection can be prevented by following the recommendations shown below. These recommendations are based on the World Health Organization's 'Five Keys to Safer Food'.⁸

Prevent a foodborne infection!



Buy

- Check the shelf-life expiry date, especially in the case of highly perishable products.
- Follow the storage and preparation recommendations printed on the packaging.
- Buy any perishable and frozen foods last, and use a cooler bag.
- Perishable products should be placed in the refrigerator as soon as possible after being purchased.



Wash

- Always wash your hands before preparing food and before eating. You should also do so after touching raw meat and uncooked vegetables, after going to the toilet, after changing babies and after touching animals (including pets).
- Wash your hands with soap, under running water, for at least 15 seconds, then dry them with a clean towel or a paper towel.
- Replace dishcloths every day. Wash dishcloths, towels and tea towels in the washing machine, at a temperature of at least 60 °C.
- Before you start preparing food, ensure that all the surfaces and kitchen utensils involved are clean.
- Wash fruit and vegetables thoroughly under running water, especially if you intend to eat them uncooked.



Separate

- Keep raw meat, raw chicken and raw fish separate from other foods.
- Do not use the same cutting board and knife for raw chicken, raw meat or raw fish, and then for cooked food or for vegetables that are to be eaten raw.



Cook

- Heat hot food thoroughly, especially meat, chicken, eggs, fish, and crustacean and molluscan shellfish.
- Also, heat any leftovers thoroughly.
- When heating food in a microwave, take it out several times and stir it.



Chill

- Store perishable food in the refrigerator, at 4 °C.
- Throw away any perishable products whose 'use by' date has passed.
- Refrigerate products quickly. Divide them into small portions; that makes it easier.
- Thaw food in the refrigerator, or in the microwave (using the defrost setting).
- Leftovers should not be stored in the refrigerator for more than two days.

Looking to the future

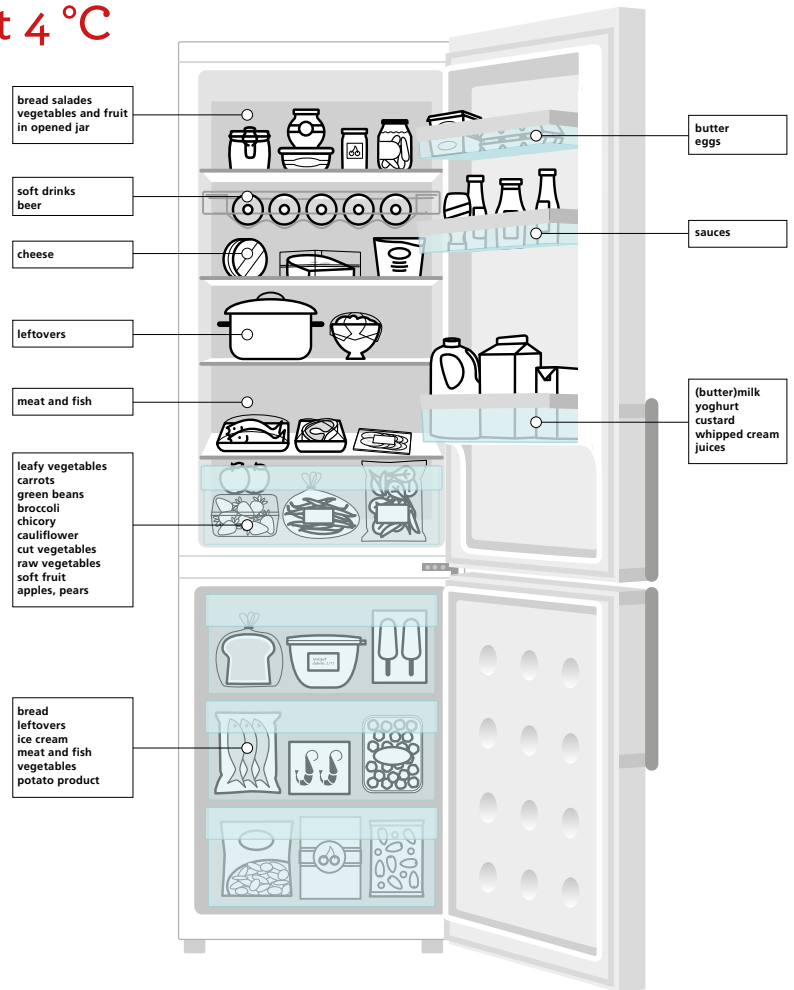
Although a great deal of food in the Netherlands is safe, food safety cannot be taken for granted. It requires considerable effort by the food processing industry, and constant awareness on the part of consumers. Lack of knowledge, in addition to awareness and alertness during food preparation,

are factors in the safe handling of food. For this reason, providing information and offering a procedural perspective on the safe handling of food, is one of the Netherlands Nutrition Centre's policy priorities. Furthermore, it is very important to give high-risk groups, such as pregnant women, information about safe dietary options, in view of the risk of listeriosis and toxoplasmosis.

Refrigerator temperature at 4 °C

Under Article 15 of the Preparation and Processing of Foodstuffs (Commodities Act) Decree, perishable refrigerated products must be stored at a temperature no higher than 7 °C. Indeed, some manufacturers indicate on the labels of highly perishable products that they must be stored at a temperature of 4 °C. While most pathogens show little or no growth at these low temperatures, there are exceptions. Bacteria such as *Listeria monocytogenes* are certainly able to grow at refrigerator temperatures, but the lower the temperature, the less quickly they can grow.

In the case of spoilage bacteria, too, the lower the storage temperature, the less likely it is that spoilage will occur. With regard both to food safety and food waste, the Netherlands Nutrition Centre's recommendation is that the refrigerator should be set to 4 °C. Note that the temperature inside the refrigerator can vary considerably. Tests have shown that the upper section may be several degrees warmer than the lower section.⁹ For this reason, the Netherlands Nutrition Centre indicates its preferred system for organising the contents of refrigerators (see illustration).



The following experts were consulted in the course of drafting this document:

Dr. B.H. ter Kuile & Dr. A.E.I. de Jong, Netherlands Food and Consumer Product Safety Authority
Prof. M.H. Zwietering, & Dr R.R. Beumer, Wageningen UR
Prof. F. van Knapen, Utrecht University
Dr. R. de Jonge & Dr I.H.M. Friesema, National Institute for Public Health and the Environment
Dr. N.E.M. Quaadvlieg, Product Board for Horticulture
Mr. H. Rang, Product Boards for Livestock, Meat and Eggs
Ms. M. Kunst, Main Product Board for Arable Farming
Mr. G.T.J.M. Theunissen, Ms A. Viloría Alebesque & Ms R. Mulder, Ministry of Health, Welfare and Sport
Dr. R. Brouwer, Ministry of Economic Affairs

Gebruikte literatuur:

- 1 Friesema, I.H.M., de Jong A.E.I., van Pelt W., Registratie voedselinfecties en -vergiftigingen bij de NVWA en het Cib, 2011, RIVM report 201111001, 2012, 33 p.
- 2 Mangen, M.J., Friesema, I.H.M., Pijnacker, R., Mughini Gras, L., van Pelt, W. Disease burden of food-related pathogens in the Netherlands 2017, RIVM report 2018-0037, 2018, 48 p.
- 3 RIVM, Nationaal Kompas Volksgezondheid – Infectieziekten van het maag-darmkanaal –, Available at www.volksgezondheidenzorg.info (version 4.9: visited on 10-12-2012)
- 4 Adams, M.R., Moss M.O., eds. Food Microbiology, 2010, 3rd Edition, The Royal Society of Chemistry, Cambridge, 462 p.
- 5 EFSA/ECDC, The European Union Summary Report on antimicrobial resistance in zoonotic and indicator bacteria from humans, animals and food in 2010, EFSA Journal 2012; 10(3): 2598, 2012, 233 p.
- 6 Bureau Risicobeoordeling & Onderzoekprogrammering, Advies over alternatief gebruik van voormalige voedingsmiddelen, Report nVWA/BuRO/2011/3031, 2011, 12 p.
- 7 van Kreijl, C.F., Knaap A.G.A.C., Ons eten gemeten - Gezonde voeding en veilig voedsel in Nederland, RIVM report 270555007, 2004, RIVM, Bilthoven, 364 p.
- 8 WHO, Five keys to safer food. Available on: <http://www.who.int/foodsafety/publications/consumer/5keys/en/>, 2012 (visited on 10-12-2012)
- 9 EFSA, Request for updating the former SCVPH opinion on *Listeria monocytogenes* risk related to ready-to-eat foods and scientific advice on different levels of *Listeria monocytogenes* in ready-to-eat foods and the related risk for human illness - Scientific Opinion of the Panel on Biological Hazards, EFSA Journal 2007; 599, 2007, 42 p.

Authors: Ms. Wieke van der Vossen-Wijmenga, MSc and Mr. Corné van Dooren, PhD. Msc.

2012 - updated June 2019