

## ... **FOODBORNE ILLNESS: its origins and how to avoid it** ...

Safety is a priority at every stage of the food chain from farm to fork, and the foods available to European consumers are usually perfectly safe to eat. However, they may occasionally become contaminated to a level which spoils the food or could cause illness if eaten. This contamination can potentially occur at every point in the food chain, from harvest or slaughter to processing, storage, distribution, retailing, final preparation and serving.

Responsibility for ensuring that food remains in prime condition is shared by everyone involved in food production and handling. Strict legal controls are in place across Europe to ensure high levels of safety, hygiene and quality in commercial processing and food handling. Food manufacturers operate quality assurance systems to ensure safe food production, and few outbreaks of foodborne diseases originate at this stage in the food chain. The greatest risk to the consumer is through mishandling of food in establishments where food is served - such as restaurants, hotels, schools and hospitals - and in the home. The home in particular is an area where improved consumer awareness of food safety issues can reap rewards in terms of risk reduction. This background paper aims to answer two major questions. How does food become contaminated by microbes? And what can the consumer do to help ensure that the food he or she eats is safe?

### **MICROBES IN FOOD**

Whether raw or processed, food is rarely sterile when it reaches the consumer. It usually contains bacteria or other microbes, most of which are harmless. Occasionally, it may also contain pathogenic microbes, which could potentially be a threat to food safety. The internal tissues of plants and animals have many defences to keep microbes at bay, with the result that healthy, freshly-harvested crop plants and fresh meat are usually sterile. However, changes after harvesting or slaughter, or during processing, may allow microbes to enter the food. These may originate from the crop plant or animal itself, from the environment, the factory environment (via soil or animals such as insects, birds and rodents) or from human sources.

Most food spoilage is due to microbial activity. Whilst spoilage does not necessarily make food unsafe to eat, it can make it unpalatable. Examples which pose little health risk are the moulds which can ruin the appearance of fruits and bread; yeast and lactic acid bacteria which can spoil sauces and beverages; and slime produced by microbes which can make chilled meat look unappetising.

### **FOODBORNE ILLNESS**

The World Health Organisation reports that, in spite of advances in modern technology and efforts to provide safe food, foodborne diseases remain a major public health concern both in developed and developing countries. In the UK, for example, foodborne illness affected one in every 1000 in 1992, double the number of reported cases in 1987. In Sweden in 1992, there were more than 5000 reported cases of salmonellosis alone. While more accurate reporting may account for some of the recent increases in reported cases, it is clear that foodborne illness remains a problem.

There are two main categories of foodborne illness:

**Infections** - These result from eating food containing pathogenic microbes which then multiply in the body. There are two types:

- Infections where the microbes attack the intestines or other organs directly, causing symptoms such as nausea, vomiting, diarrhoea and fever. Here, there may be a gap of several days between eating the infected food and the appearance of symptoms, due to the time taken for the microbe to multiply. Examples are the infections caused by the bacteria *Salmonella*, *Campylobacter* and *Listeria monocytogenes*.
- Infections where symptoms such as diarrhoea result from poisons or toxins produced by the microbes as they grow in the intestine. Here, the time taken for symptoms to appear can vary from several hours to several days after eating infected food. An example is the illness caused by a toxic strain of the bacterium, *Escherichia coli*.

**Intoxications** - These result from eating food which contains toxins produced by microbes which do not need to grow in the human body to cause illness. Symptoms can begin only a few hours after eating contaminated food. An example is botulism, caused by a toxin from the bacterium *Clostridium botulinum*.

### **SPECIAL CONSIDERATIONS**

Pregnant women, babies, young children and the elderly have particular needs which require special care in selecting, storing and preparing food. In general, people with reduced natural defences should particularly protect themselves against foodborne diseases. People taking certain kind of drugs, including antibiotics and chemotherapy treatment, are also more susceptible than normal to microbially-caused food disease.

### **WHICH FOODS POSE THE GREATEST RISK?**

Foods of animal origin are the primary source of many food poisoning microbes, such as *Salmonella*, *Listeria*, *Campylobacter*, *E coli* and *L monocytogenes*. These may occur on the live animal, and remain in the meat after slaughter. Without appropriate treatment to kill the microbes, or if conditions of hygiene or temperature control are poor, microbes may still occasionally be present in the final food product.

Foods which pose a relatively high risk of foodborne illness include:

**Poultry, meat & eggs** - The incidence of contamination is probably highest in poultry. Here, rapid growth in poultry production has resulted in a readily-available source of meat. However, there has been increased infection with food poisoning microbes in poultry, meat and eggs. Eggs can carry bacteria such as *Salmonella enteritidis* on their shells or within the egg. *Salmonella* infections are on the increase across Europe. An important precaution in preventing foodborne illness from poultry and eggs is thorough cooking; the World Health Organisation recommends that raw egg should be viewed as a potentially hazardous ingredient which should not be used in foods which will receive no further heat treatment.

**Red meats** - These can also be contaminated with pathogenic microbes, probably to a lesser extent than poultry. The process of grinding meat to make mince and burgers may spread the microbes from one source into many products. As for poultry products, red meats should be thoroughly cooked before serving.

**Dairy products** - Raw milk can contain various pathogens from the dairy animal or its environment. Pasteurization destroys all pathogens, and sterilisation ensures that the product is free from all microbes. Whilst pathogens are inactivated by many of the methods used to produce dairy products - including acidification and fermentation of milk - certain types may sometimes survive. Hard cheeses, yoghurt and butter are regarded as safe because of their acidity or lack of moisture, but mould-ripened soft cheeses can allow growth of *Listeria monocytogenes*.

**Shellfish** - As filter feeders which extract their diets from large volumes of water, shellfish can concentrate pathogens in their bodies. Inadequately heat-treated shellfish can cause a range of infections due to bacteria (such as *Vibrio* and *Shigella*), various parasites or viruses.

**Herbs and spices** - These frequently carry large numbers of bacteria such as *Bacillus cereus*, *Clostridium perfringens* and *Salmonella*.

## HOW PROCESSING PROVIDES PROTECTION

Commercially manufactured foods are designed to be safe. A number of common preservation methods are used to destroy microbes or stop them from growing, including:

- Heat treatments such as pasteurisation and sterilisation.
- Canning.
- Low temperature storage, for example, refrigeration and freezing.
- The addition of chemical preservatives, such as organic acids and nitrites.
- Natural antimicrobial products, such as nisin.
- Fermentation.
- Control of water content through drying, salting or smoking.
- Modification of the atmosphere in which the food is packed, for example, vacuum packing and gas packing.

Less widely-used preservation methods include high pressure and irradiation, together with novel technologies such as treatment with electricity or pulsed light treatment.

There remains a slight possibility that foods can become contaminated after processing. This can largely be avoided if everyone involved in handling food follows a good hygienic practices.

## AVOIDING FOOD CONTAMINATION

Food safety is a shared responsibility of everyone involved in the food chain from farm to fork. This includes primary producers, food companies, establishments which serve food, and consumers.

At the farm level, there are critical control points at every stage in animal rearing and crop agriculture where contamination of produce can be minimised by following good practices. After slaughtering, for example, inspections are carried out to separate diseased meat from healthy meat. However, even healthy animals can carry human pathogens and their meat can also become contaminated during slaughtering. These pathogens can be difficult to eradicate. Fresh fruits, vegetables and herbs can also become contaminated if they are fertilised with animal manure or come into contact with impure water. Crop plants may be treated to destroy pathogens - for example using biocidal washes - but such treatments are not always carried out.

At the food manufacturer level, the majority of companies have in-house quality assurance systems to ensure the safe production of food. Throughout the European Union, there are moves towards less prescriptive regulation and greater emphasis on industry responsibility. Measures currently used to help prevent contaminated food from reaching the consumer include:

- Using good quality raw materials from assured suppliers.
- Following Good Manufacturing Practices. Using management systems which allow the identification, monitoring and control of hazards during production, processing and sale of food.
- Providing training programmes for all food industry personnel. Carrying out research on pathogens and how best to control them.
- Exchanging information on food safety.

At the next level of the food chain from farm to fork, many foodborne diseases occur either as a result of mishandling in catering establishments or in the home.

A number of simple rules are recommended by the World Health Organization to ensure the safe preparation of foods:

- Avoid contact between raw and cooked foods, to reduce the risk of cross-contamination. Wash hands before handling and after handling raw foods, to minimise possible contamination.
- Cook food thoroughly in order to kill any microbes present. All parts of the food should reach a temperature of at least 70 degrees Celsius.
- Cool cooked foods as quickly as possible and then refrigerate. This slows down or stops microbial growth, which occurs best at 10-60 degrees Celsius.

- Reheat cooked foods thoroughly, to kill tiny microbes which may have developed during storage.
- Keep all kitchen surfaces clean to prevent cross-contamination.
- Protect foods from insects, rodents and other animals which may carry pathogenic microbes

## FURTHER READING

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