FOOD SAMPLING

A guide for food businesses as to why samples are taken and the interpretation of the test results

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Why do we need to take samples for testing?

It is the job of your local council to ensure that food sold or produced in their area is safe to eat. It is an offence for food premises to sell food that is: -

- unfit for human consumption
- so contaminated that it would not be reasonable to expect it to be used for human consumption
- is not of the nature, substance or quality demanded by the purchaser, or is falsely advertised

Samples may be taken by your local council as part of their routine hygiene inspections. In addition they may take samples as part of a local or national study looking at particular types of foods.

Food samples are taken in accordance with the Food Law Code of Practice and associated practice guidance.

Sometimes food samples are purchased over the counter in the same way as a member of the public would buy them; this enables us to test hygiene standards at point of sale. On other occasions the sampling officer will make themselves known to the person selling the food. This may be when we need to test components of a particular food, or when we need to ask specific questions as part of a food study, or occasionally when investigating cases of foodborne illness.

Once the samples have been taken they are placed in a cool box and sent to the laboratory for testing. In England, your local council uses the Public Health England (PHE) Food Water Environmental laboratories for testing samples.

PHE laboratories are accredited by the United Kingdom Accreditation Service (UKAS) to ensure that they are competent to perform the testing.

What do we test for?

The laboratory tests the food sample for the presence of a range of bacteria. The types of bacteria looked for will depend on the type of food, and whether it was sampled at point of sale or during the production process. Certain foods are required by law to meet prescribed levels of bacteria as stated under European legislation. Other foods may be judged against microbiological guidelines such as those published by PHE on ready to eat foods at point of sale.

The types of bacteria we look for generally fall into two groups; Pathogens and hygiene indicators.
We may also test for the overall numbers of bacteria in a food sample; this is called the aerobic colony count (ACC)

BACTERIAL PATHOGENS.

These are bacteria which could cause illness if present in the food. The ones we routinely look for are:

Listeria monocytogenes

Illness is caused by the ingestion of live bacteria. This bacterium occurs commonly in the environment and in raw foods. *Listeria* is killed by adequate cooking, so post cooking contamination from the environment or from raw foods probably represents the greatest risk of causing illness. *Listeria monocytogenes* is able to grow at low temperatures (albeit slowly), and can be a risk in chilled ready to eat foods with a long shelf life. Therefore unrefrigerated foods and those chilled for extended periods are at increased risk of allowing significant growth of this organism.

Listeria monocytogenes has been associated with certain foods such as, pate, soft cheese and salads. It has the potential to cause severe infection in certain groups of people, such as pregnant women, infants, the immuno-compromised and the elderly.

Salmonella

There are over 2500 different types of *Salmonella*. Infection is caused by the ingestion of live bacteria.

Salmonella can be found in the intestines of many animals, and as such can contaminate raw meat products during slaughter and processing. This means that they can end up on the surface of the finished carcass, or in the case for minced meat, throughout the product. *Salmonella* is killed during the cooking process, so the presence of this bacterium in cooked foods generally indicates inadequate cooking or post cooking contamination. *Salmonella* can also be found in raw eggs and also in raw spices and herbs used to garnish cooked foods.

Campylobacter

This bacterium is the most common cause of gastrointestinal infection in the UK. Infection is caused by the ingestion of live bacteria. Like *Salmonella*, *Campylobacter* can be found in the intestines of many animals and so may be present on raw meat, particularly poultry.

This organism is killed by adequate cooking, so a significant risk is undercooking, and post cooking contamination from raw meats and contaminated surfaces. Contamination of surfaces during the preparation of raw poultry is a particular risk if the meat is washed before cooking. Washing raw poultry under a running tap causes splashing resulting in the spread *Campylobacter* in the water droplets. This practice can result in the contamination of large areas of the food preparation area.

Campylobacter can also occur in unpasteurised dairy products such as raw milk or cheeses made from raw milk.

***Escherichia coli* O157**

Escherichia coli (*E coli)* are found in the intestines of animals including man. The majority of *E coli* strains are harmless and form part of the normal flora of the gut.

However, there are some strains which can cause illness, of which *E coli* O157 is an example. These pathogenic strains are referred to as VTEC or STEC which refers to the toxin they produce. *E coli* O157 (and other VTEC / STEC) cause gastro-intestinal infection; they can also cause severe infection of the kidneys, particularly in young children. Infection is caused by ingestion of live bacteria, and often only small numbers are required to cause illness. As *E coli* are killed by cooking it should not be present in cooked foods. It has been found to occur in undercooked beef products such as beef burgers and in unpasteurised dairy products.

1. ***Bacillus cereus***

Illness caused *by Bacillus cereus* is due to production of a toxin either in the food itself prior to consumption, or in the intestine after ingesting the food containing the live bacterium. In both cases large numbers of the bacterium are required to be present in the food for illness to occur. There are other species of *Bacillus* which can also cause illness similar to *Bacillus cereus*.

Bacillus bacteria are able to produce spores which allow the bacterium to survive for long periods in adverse conditions. As such they are found widely in the environment and in dry foods such as cereals, spices and dried meats. The spores are able to survive the cooking process; therefore it is important to prevent any surviving spores that may be present from germinating after cooking. If the food is not going to be consumed immediately after cooking then it should be rapidly cooled and kept in the fridge.

Illness caused by *Bacillus cereus* has been associated with cooked rice. Usually where large volumes have been cooked in advance which is then allowed to cool slowly over several hours.

The toxin produced in the food by *Bacillus cereus* is very heat resistant and may not be destroyed by the subsequent re-heating process prior to eating.

Clostridium perfringens

This bacterium is present in the guts of animals, including man, and is also found in the environment. Like *Bacillus* it can produce spores which can survive the cooking process. Illness is caused by ingesting large numbers of living bacteria which produce a toxin in the intestines, causing diarrhoea. Control is achieved by preventing germination of surviving spores and subsequent multiplication of bacteria post cooking. Therefore rapid cooling, adequate cold storage and adequate re-heating are all important in controlling the risk of illness.

This bacterium is anaerobic, which means that it does not grow in air. Therefore for it to be able to grow, specific conditions are required where oxygen has either been reduced or is absent. This can occur within large joints of meat or in dishes that have been simmered for long periods, and then not cooled or stored correctly.

Clostridium perfringens food poisoning, although uncommon, has been linked to the inadequate cooking and storage of cooked meat joints

and of meat based dishes such as stews, casseroles and gravy. *Clostridium perfringens* can also occur in packaged products where the oxygen has been deliberately removed in order to extend shelf life, e.g. vacuum packed and modified atmosphere packed meats.

Staphylococcus aureus.

This bacterium belongs to a group of bacteria sometimes referred as Coagulase Positive Staphylococci. *Staphylococcus aureus* can be found as part of the normal flora on human skin and can be carried in the nose, hairline and other areas. Although *Staphylococcus aureus* can cause food poisoning, it can also cause infection in wounds and in spots and acne. For these reasons the main route of transmission to foods is via the food handler. Therefore proper protection is important when handling foods, such as hand washing, covering cuts, wearing gloves and beard snoods. The presence of this bacterium in foods indicates poor hygiene practices.

1. 

Once in the food and if stored under inadequate refrigeration, the bacterium can grow. Certain strains can produce a toxin in the food which is then ingested when the food is eaten which leads to illness. Although the bacterium is killed by cooking, the toxin produced is heat resistant. So if growth has occurred prior to cooking any toxin present may persist after a cooking or re-heating process is applied.

Food items at most risk are those where preparation includes handling such as sliced meats, cream cakes etc, and where they have then been allowed to sit at room temperature for extended periods of time before being eaten. E.g. at large catering functions where there may be inadequate capacity for cold storage of foods.

Staphylococcus aureus can also occur in dairy products such as raw and ripened cheeses; here the origin may be the milking herd, as this organism can also cause infection of the udder.

HYGIENE INDICATORS.

These are bacteria or groups of bacteria that although not in themselves harmful, can indicate poor practice that may be one or more of the following:

- Poor quality raw materials
- Undercooking
- Cross-contamination
- Poor cleaning
- Poor temperature and time control

The presence of indicator organisms may reflect an increased likelihood of bacterial pathogens being present.

Also, indicator organisms are useful in the assessment of food safety as they tend to be present in higher numbers than most pathogens.

The indicator organisms most commonly looked for in foods fall into three groups; Enterobacteriaceae, *E coli* and *Listeria* species.

Enterobacteriaceae

This is a group of bacteria that is used to assess the general hygiene status of a food or food product. Enterobacteriaceae include a wide range of different bacteria that can be found in the guts of animals and man, as well as plants and the environment. All members of the Enterobacteriaceae are killed by the heating processes used in food production, and are also readily removed from production equipment and surfaces by adequate cleaning procedures. Their presence in heat treated foods therefore signifies inadequate heat or post processing contamination. Enterobacteriaceae occur naturally in some food types such as salad vegetables. The use of sanitizing rinses may reduce but will not entirely

remove these organisms from salad vegetables.

***Escherichia coli* (*E. coli*)**

This organism belongs to the Enterobacteriaceae family and is found in the guts of animals and man, and is used as an indicator of faecal contamination. There are many strains of *E.coli* and most exist harmlessly in the gut, although there are some strains such as *E. coli* O157 which are pathogenic in man (see Bacterial Pathogens section above). *E. coli* is killed by the cooking process and is readily removed from equipment and surfaces by appropriate cleaning procedures. *E. coli* can be found in raw meat products through faecal contamination at slaughter. The presence of *E. coli* in cooked foods indicates inadequate cooking or post cooking contamination from contact with uncooked product, or from food handlers due to poor personal hygiene.

Listeria species

These organisms *are* commonly found in the environment and may contaminate surfaces and equipment that has been inadequately cleaned. Although these organisms are killed by cooking they do show a greater resistance to heat than the Enterobacteriaceae. Their presence in cooked foods indicates undercooking or post cooking contamination.

Although most species are non-pathogenic, their presence indicates the potential that the main pathogenic strain, *Listeria monocytogenes*, may also be present.

The ability for *Listeria* species to grow at refrigeration temperatures means that their presence at any level in certain refrigerated long life products (e.g. soft ripened cheeses, pate, smoked fish, sliced meats) is significant, as this could result in high levels of *Listeria monocytogenes* building up during the product's shelf life.

AEROBIC COLONY COUNTS

The aerobic colony count (ACC), sometimes also stated as the Total Viable Count (TVC), is an estimation of the total number of bacteria in the food. The number actually grown will depend on the conditions of the test and will usually be undertaken in air at 30^0C. The ACC is used as an indicator of quality, not safety. Used on its own, the ACC does not allow assessment of the safety of a ready to eat food. The ACC is usually taken in conjunction with the results of other tests.

The type of food product also affects how the results are assessed as some foods will naturally have a relatively high ACC, e.g. cheeses, live yoghurt, and fermented foods. Conversely, in other food types we would expect a very low ACC, e.g. shelf stable bottled or canned foods, or foods sampled immediately after cooking.

ACCs can be used as part of a general quality assessment, including investigation into shelf-life. Monitoring of ACC allows action to be taken if results are above a pre-determined "expected" level.

1. High counts may suggest quality issues in production or during storage, such as poor temperature control, or contamination from inadequately cleaned equipment, e.g. sliced meats being contaminated by a dirty meat slicer.

The ACC in a food is often composed of mixed organisms; however sometimes during the product shelf-life a single type of organism may come to predominate, this can lead to spoilage issues such as production of slimes, taints and discolouration.

REPORTING THE RESULTS

The testing laboratory will issue a Test Report to your local council department who took the sample. This consists of 3 sections:

Sample details

This includes details of the premises where the sample was taken and a description of the sample taken.

Test results

This is a list of the tests performed on the sample and the results of the tests.

Comments and opinions

This may contain test specific comments or general comments on the overall quality of the sample.

Interpretation

There may be an interpretation against each test result and / or an overall interpretation of the test results. The interpretation made will also make reference to the legislation or guidance on which the interpretation has been based. Test results are interpreted as being: -

Satisfactory: Test results indicate good microbiological quality

Borderline: The result is on the upper limit of acceptability and may indicate potential issues which could lead to public health related problems.

Unsatisfactory: For pathogen tests an unsatisfactory result indicates a product that is potentially injurious to health and / or unfit for human consumption and requires immediate remedial action. For hygiene indicator tests an unsatisfactory result requires review of procedures.

A note on numbers:

Some tests are reported as cfu/g. This refers to the number of colony forming units (living bacterial cells) per gram of food. The laboratory test report will normally report these enumeration results in scientific notation; this allows us to record otherwise large numbers in a standard format. Some examples of scientific notation are given below along with their long hand equivalent:

$5x10^2$ = 500

$1.0x10^3$ = 1000

$2.5x10^5$ = 250 000

Some enumeration test results may be reported with < in front of the number e.g. <20, <100. This means that there was less than 20 or less than 100 cfu/g. The less than symbol denotes that the result is the minimum level of detection for the test concerned, and basically means that the organism was not detected in the sample examined.

Some tests require a specific portion size of the food to be examined. With these tests we are looking to see whether or not the organism being tested is there or not. These tests are reported as either Detected or Not detected in the portion of food examined (usually 25g).

WHAT HAPPENS NEXT?

Where unsatisfactory or borderline levels are obtained your local council will usually want to talk to you to discuss your results. This may involve reviewing processes and procedures and giving advice on remedial action. In some cases further sampling may be undertaken. This may include taking swab samples of surfaces and equipment if cross-contamination is suspected or for verifying cleaning practices.

Satisfactory results offer you reassurance that your procedures and processes are under control; but remember this is only a snapshot. Ongoing diligence and compliance with your procedures will allow you to maintain this good level of microbiological quality.

Enforcement action relating to microbiological results is rare, but may be considered in extreme cases or where repeated unsatisfactory results are obtained.

If you would like to discuss your results please contact your local council department, the details of which are given at the end of this document.

REMEMBER THE 4 Cs!

Good food hygiene is all about controlling the presence of harmful bacteria. There are four main things to remember in order to achieve good hygiene, these are known as the 4 Cs: -

Cross-contamination

Cleaning

Cooking

Chilling

Cross-contamination is when bacteria are spread between foods, surfaces or equipment, or via the food handler. It is most likely to happen when raw food comes into contact with (or drips onto) ready-to-eat food; or when ready to eat food comes into contact with equipment or surfaces used for or contaminated by raw food.

Effective cleaning gets rid of bacteria on hands, equipment and surfaces, and so helps to stop harmful bacteria from spreading onto food.

Thorough cooking kills harmful bacteria in food. So it is extremely important to make sure that food is cooked properly. When cooking or reheating food, always check that it is steaming hot all the way through.

Chilling food properly helps to stop harmful bacteria from growing. Some foods need to be kept chilled to keep them safe, for example foods with a 'use by' date; i.e. cooked dishes and other ready-to-eat food such as prepared salads and desserts. It is very important not to leave these types of food standing around at room temperature

RECOMMENDED FURTHER READING

The Food Standards Agency has produced a series of publications around Safer Food Better Business

For more information and to download the information packs visit their website:

http://www.food.gov.uk/business-industry/caterers/sfbb

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