

Microbial update

poultry production

by Dr Roy Betts, Campden and Chorleywood Food Research Association, UK.
Produced as a service to the food industry by Oxoid Ltd.

Dr Roy Betts is head of the microbiology department at Campden and Chorleywood Food Research Association, UK (CCFRA). CCFRA is one of the largest independent food research organisations in the world offering advice, information, and scientific and technical consultancy to all parts of the food and associated industries on a worldwide basis.

The term 'poultry' includes such various bird types as chicken, turkey, duck, goose, guinea fowl and can sometimes be used with species such as pigeon, ostrich, pheasant and other game birds. It is clear, however, that in most countries the predominant birds included within the term 'poultry' are chickens and turkeys, and in the EU and USA approximately 70-80% is made up of chickens, while approximately 19% will be turkeys.

Poultry meat is often seen as a relatively inexpensive, high protein, low fat meat. From the consumers' viewpoint, it has been developed over recent years, from essentially a 'carcase' product, to a large range of partially processed or fully processed, added value products, for example, portions, reformed rolls, grillsteaks, burgers, nuggets, sausages, cooked sliced portions and ready meals.

As a food, poultry is popular, it has a 'healthy' image and is widely available throughout the world. It has, however, been reported to be a fairly common cause of human foodborne disease, salmonella and campylobacter both being commonly linked to poultry and poultry products.

To look at the reasons behind the common linkage of poultry with human food poisoning, two areas can be considered:



- The contamination and carriage of human pathogens by live poultry and subsequently by carcasses and raw poultry products.
- The handling and use of raw poultry meat by the end user.

Contamination of flocks

A large proportion of chickens and turkeys are intensively reared in large poultry houses. In this type of situation contamination of live birds with human pathogens can arise through many routes. All need to be considered and adequately controlled.

Sources of pathogens could include feed, drinking water, general environment (soil, litter, dust, air) or other animals (insects, rodents, wild birds). In addition, staff tending the flocks could serve to infect or spread micro-organisms.

Once individual birds in a house are infected with a human pathogen, it can be transmitted easily around the rest of the flock.

Primary processing

When ready for slaughter, birds will be transported to the slaughter plant. They are usually carried in crates and unless crate hygiene is considered, this could serve to spread contamination between birds, as crates will become contaminated by waste materials.

Once at the slaughter plant, birds will be stunned and killed, then go through a range of processes that, unless well controlled, could result in the spread of microbial contamination.

Scalding, defeathering, washing and evisceration are all steps that could aid the spread of microbial contamination and require control.

Of course once a bird is contaminated with a human pathogen, it is unlikely ever to 'lose' that contamination until it is cooked. So one of the main areas of research into poultry production over recent years has been the target of raising birds that do not harbour human pathogens. This has proved a difficult objective to achieve.



The widespread vaccination of UK poultry flocks against salmonella, has reduced the incidence of this organism considerably and this, together with better biosecurity on farms, has helped to reduce the level of salmonella contaminated raw chicken from 79% whole raw birds contaminated in 1979/80 to 5.8% in 2001.

This considerable reduction has been matched in the UK by a reduction in salmonella contaminated eggs from 1% in 1995 to <0.4% in 2005.

This general reduction in salmonella contamination in poultry and poultry products, has been mirrored by a reduction in the numbers of cases of salmonella food poisoning in the UK.

Unfortunately, this positive result for salmonella reduction has not been the same for campylobacter. Various surveys over recent years have indicated that over 50% of raw poultry on retail sale can contain campylobacter.

It is clear that raw poultry can be a source of human pathogens and while measures have been successful in reducing the numbers of salmonella contaminated poultry on retail sale, there is still an issue with campylobacter contamination.

Handling of raw poultry

An understanding that at the present time raw poultry can be contaminated with human pathogens, means that a major control measure to reduce the risk of these products causing food poisoning, is the application of good hygiene practices during food preparation and correct cooking of raw poultry before consumption.

Care must be taken when handling raw poultry in food preparation areas. Risks of cross contamination from raw poultry to ready to eat products should be assessed and as far as possible eliminated.

There is evidence from epidemiological studies that many outbreaks and cases of food poisoning can be traced to poor food preparation practices in kitchens. These may allow pathogens from raw poultry sources to contaminate ready to eat products and therefore infect consumers.

Spoilage of raw products

The surfaces of raw poultry will harbour a range of different types of micro-organism that can grow under the chilled conditions used for storage.

Pseudomonas, *acinetobacter*, *shewanella*, and *moraxella* have all been isolated from chilled aerobically stored raw poultry, whilst packaging in more oxygen impermeable films will move the population towards less oxygen dependent bacteria (*lactobacilli*, *brochothrix* and the *enterobacteriaceae*).

It has been observed that different organisms develop differently on different parts of poultry carcasses.

The pH of leg muscle is higher than that of breast, *pseudomonas* can grow equally well at both pHs, whereas spoilage organisms such as *acinetobacter* and *shewanella* are reported to grow better on leg than breast muscle.

The major control of the growth of spoilage organisms on raw poultry will be storage temperature.

The lower the temperature, the slower the growth of spoilage organisms and the longer the potential shelf life of the product.

Cooked poultry products

A large variety of cooked poultry products are now available in retail stores. These range from cooked whole birds, through ready to eat sliced products, to ready meals in which poultry forms the main protein source. Most of these products will have received some sort of heat process or cook during their production, and will be distributed and stored under chilled conditions. The major preservation system for these products will be chilled storage which will reduce the growth rate of spoilage organisms and help lengthen shelf life.

The cooking processes used in the production of these type of products will usually be designed to give an adequate 'kill' of food pathogens that may be present on the raw poultry.

In the UK a minimum process designed to give a 6 log reduction of vegetative pathogens (for example, *salmonella* and *listeria*) will often be used (for example, 70°C for two minutes at the slowest heating point within the product).

This will be adequate to eliminate the risks



from vegetative pathogens on such cooked products, however, producers must implement procedures that will prevent the risks of product recontamination after cooking.

One of the major issues with respect to pathogens in such processed products, will be recontamination with *Listeria monocytogenes*. This organism can survive and grow at low temperatures and can be a major problem in child food production factories. If a production site is contaminated with *listeria*, then product recontamination after processing can occur.

As *listeria* can grow at low temperatures then product contamination during production, can result in further growth of the organism during storage and this could result in a risk to health.

Most producers of such processed chilled products will have a rigorous *listeria* testing policy for both product and the production environment. This will alert them to any potential problems and allow appropriate corrective actions to be taken before any risk to health occurs.

Conclusions

Poultry and poultry products can provide a nutritious, healthy and relatively inexpensive source of food. Raw poultry can harbour human pathogens and must be handled with care during food preparation to limit risks of contamination of ready to eat products or the food preparation environment itself. Correct cooking of poultry will eliminate vegetative pathogens such as *salmonella*, and *campylobacter*.

A wide range of prepared poultry products are now available in retail stores. These will usually have been cooked by the manufacturer and this will have killed any vegetative pathogens that may have been present on the raw poultry used in production.

Manufacturers of such products should be aware of the risks of recontamination of

cooked products with various micro-organisms, but particularly the potential pathogen *Listeria monocytogenes*.

Monitoring systems for *listeria* in such production environments is usually undertaken by manufacturers, to allow early detection of *listeria* so that remedial action, if required, can be taken. ■

FaxNOW +44 1256 329728

✉ val.kane@thermofisher.com

References

- The International Commission on Microbiological Specifications for Foods (1998). *Micro-organisms in Foods, Book 4, HACCP in Microbiological Safety and Quality*. Oxford, UK: Blackwell Scientific Publications.
- Forsythe, F. J. & Hayes, P. R. (1998). *Food Hygiene, Microbiology and HACCP*, 3rd Edition. Maryland, USA: Aspen Publishers Inc.
- Bridson, E. Y. (1998). *The Oxoid Manual*, 8th Ed. Basingstoke, UK: Oxoid Ltd.
- Advisory Committee on the Microbiological Safety of Food (1996). *Report on Poultry Meat*. London, UK: HMSO.
- Jay, J. M. (2000). *Modern Food Microbiology*, 6th Ed. Maryland, USA: Aspen Publishers Inc.
- www.food.gov.uk
- The International Commission on Microbiological Specifications for Foods. (1998). *Micro-organisms in Foods, Book 6, Microbial Ecology of Food Commodities*. Blackie Academic & Professional. London.
- Lund, B. M., Baird-Parker, T. C. and Gould, G. W. (Eds) (2000). *The Microbiological Safety and Quality of Food. Vol 1*. Aspen Publishers Inc. Gaithersburg, Maryland.
- Photographs courtesy of Shutterstock.