# A practical overview of foodborne pathogen control and meat safety

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Safety and quality are two key prerequisites in the production of food for human consumption. In this article we will consider the production of safe poultry meat and, in so doing, look at the different levels in the production chain and what can be done at each to ensure the consumer has safe poultry meat to eat.

On this occasion, we will focus on microbiological hazards, but it is important to remember that there are other hazards, such as chemical residues.

## **Rise of campylobacter**

Historically, poultry have always been associated with salmonella but, in more recent times, another food poisoning bacterium, campylobacter, has taken over the mantle as the most common cause of poultry related food poisoning in many countries.

A good example of this is in the UK. In Fig. I we can see the impact of salmonella vaccination on the incidence of human food poisoning.

Much of this was probably associated with Salmonella enteritidis contaminated table eggs, but it would be imprudent to say that this was not also a problem in the broiler sector.

If we look at the causes of food poisoning



Fig. 1. Laboratory human isolates of campylobacter and salmonella over recent years for England and Wales. The arrow denotes the start of salmonella vaccination of poultry in the UK. Note that campylobacter isolates have remained static, whereas there has been a dramatic improvement in the salmonella picture.

that are associated with poultry meat, they can be divided into those which have their origins on the farm and come into the poultry processing plant with the birds, such as salmonella and campylobacter, and those which are resident in the processing or further processing, including post cooking, sections of the processing plant.

A good example of this latter type of organism is Listeria monocytogenes.

If we take the broiler farm as the source of birds, and hence food poisoning organisms that accompany the birds into the plant, salmonella is a very good example to focus on. There are many sources of salmonella (see Fig. 2), but the most important are day old chicks, the feed, the bedding material (especially straw and rice hulls), the drinking water and vermin and wild birds.

## **Realistic targets**

Total elimination of all serotypes of salmonella from every farm is probably a pipedream, but serious minimisation of the problem is a realistic and a practical goal.

If we first look at the day old chicks, the salmonella status of the breeder farm, especially in relation to those serotypes of salmonella such as S. enteritidis and S. typhimurium that can be vertically transmitted, is very important.

We need to stop these serotypes getting into the farm and all the measures that we will soon consider for the broiler farm are just as important, if not more so, at the breeder farm level.

Breeder feed should be 'salmonella free' and this can be achieved by a combination of not sourcing known contaminated ingredients and treating the feed by heat and/or chemicals, such as acids and their salts, that will kill salmonella.

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At the breeder level the option of vaccination is an important management intervention strategy. Vaccination is principally used to counter S. enteritidis and S. typhimurium but it invariably gives cross protection to the birds against other salmonella in serogroup B (typhimurium) and serogroup D (enteritidis).

#### **Reduce shedding**

Vaccination will not totally eliminate salmonella from an infected flock but it will reduce its shedding from the birds to virtually zero.

This will go a long way towards controlling

the problem. This is because vaccination greatly reduces the shedding of salmonella from the bird and this, in turn, greatly reduces and usually eliminates vertical and horizontal spread of infection. The recipient chick or bird does not receive an infectious dose of the organism and so infection does not become established in it.

In addition, the resulting chicks receive a 'protective umbrella of maternal antibody' from vaccinated parents and this will counter salmonella infections the chicks come into contact with. Another strategy that helps the chicks is the use of competitive exclusion products.

Other than the day old chick and the feed, there are various other sources of salmo-

nella contamination for the broiler flock. An important aspect of salmonella control or any food safety orientated strategy is to ensure that staff know what the company is hoping to achieve, how it will achieve it and the important role of staff in doing this.

The importance of not taking staff food into poultry houses, regularly washing and sanitising hands and always using the provided toilet facilities can never be over emphasised.

#### Source of your water

Water can be contaminated at source. For this reason it is best not to source the water your birds are going to drink from surface supplies such as ponds and lakes as wild waterfowl that frequently carry salmonella (and Newcastle disease and avian influenza viruses) frequent these.

If you are going to source water from a river be aware of what is up stream. For example, it is not prudent to source your water downstream from a sewage outflow!

One would think borehole water would be safe. However, this is not always the case as the fluids from dead bird pits can seep down to the aquifers that the water is drawn from. In the past, this has been shown to be the source of a recycling S. enteritidis problem and recycling colisepticaemia on poultry farms.

One would expect that the air would be safe but sometimes it can be the source of infection. Think of a broiler farm near a main road down which pass lorry loads of spent table egg layers with the wind blowing from the road to the farm.

Wild birds and vermin can carry salmonella and it is found in their droppings. Thus, poultry houses need to be wild bird and vermin proofed and we must not inadvertently carry droppings into the broiler house on our boots or equipment.

For this reason, the practice of having dedicated boots and overalls inside each house for staff use has to be applauded. In addition, the area surrounding the poultry houses should not be attractive to wild birds and vermin. This means short grass or concrete, no feed spills, no roosting points and no sources of drinking water.

In this context, we should not overlook lizards that can be notorious carriers of salmonella or insects such as Alphitobius that can carry the organism between crops.

#### Farm inputs strategy

Anything coming on to the farm and/or into the broiler houses has the potential to bring salmonella with it.

So, we need a strategy to minimise farm inputs and when something has to come on to the farm we need to control its entry and subject the item to appropriate cleaning and disinfection.

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Practices such as flock thinnings are very dangerous because there is a real risk of salmonella or campylobacter contaminated lorries, forklifts and crates or modules going on to the farm and into the broiler houses.

Crate washing and sanitisation is important because it would be a great pity, having done all the hard work on the farm, to then contaminate your birds with salmonella or campylobacter from poorly cleaned and disinfected crates!

L. monocytogenes is a totally different story. Typically this bacterium gets into the post cooking zones in a processing plant and becomes a resident there. Then product is regularly contaminated. It should be noted that now we are talking about the contamination of cooked products and they differ greatly from raw products in that they will not be cooked again and cooking, providing it is done properly will rid poultry meat of food poisoning bacteria. Therefore, these present a greater risk to the consumer.

### **Consumer handling**

The problem with fresh poultry meat is that it is often handled badly by the consumer prior to cooking.

For example, it may be stored in the refrigerator above a cheesecake or a bowl of salad and the contaminated juices from the poultry meat drip on to and then contaminate the salad or cheesecake.

Another common problem is encountered at barbecues when cooked meat is recontaminated by returning it to the plate that the raw meat was originally on.

L. monocytogenes control is totally different. Here the strategy is to prevent the bacterium getting into the post cook area but to design that area so that if L. monocytogenes does get in, it can be removed by a thorough and intensive routine cleaning and sanitisation programme.

A key prerequisite is to build the facility so that it is easy to clean and has no hiding places in which L. monocytogenes can survive and multiply.

The same needs to be the case with the equipment and a golden rule here is no plastic because as plastic ages and its surface is damaged it becomes harder and harder to effectively sanitise. All equipment should be designed so that it is easy to clean and sanitise.

#### **Eliminate biofilms**

Biofilms are notorious at harbouring L. monocytogenes and so our cleaning and sanitisation programme should use a substance that can destroy biofilms at least once a week.

However hard we try some listeria will, from time to time, get on the floor and management must ensure that equipment, trays and buckets are never moved from the floor to production surfaces.

Routine spraying of floors in the post cook area with a food grade disinfectant of the quaternary ammonium kind is worthy of serious consideration.

Whichever food poisoning organism we are talking about it is important that we have an adequate monitoring programme in place.

Firstly, this can help in strategic planning. For example, if we find a particular house on a broiler farm to be salmonella positive we can schedule it for the last kill in the day so that following its kill the processing plant will be immediately cleaned and sanitised and/ or we can direct those birds towards our cooking operation rather than let them go into fresh products.

Our monitoring programme will also tell us if our cleaning programmes are effective and identify risky inputs such as feed, day olds, bedding material and, in the case of further processing, risk ingredients. Herbs and spices are notorious carriers of salmonella!

In this article we have highlighted many of the facets of controlling microbes such as salmonella and L. monocytogenes that can compromise the safety of poultry meat.

The best way to summarise their control is that, in this context, foodborne pathogen control is like a chain – it is only as strong as its weakest link!