FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
POULTRY DEVELOPMENT REVIEW

Poultry and poultry products - risks for human health

Slaughtering and processing

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INTRODUCTION

Handling of live birds brings perhaps the greatest risk of exposure to viruses for farmers, their families and poultry workers in areas where highly pathogenic avian influenza (HPAI) is present. A study in Guangzhou, China in 2007 to 2008 found that 15 percent of poultry workers in live poultry markets, where the birds are also slaughtered, had antibodies against HPAI. This compares with only 1 percent in the general population (Wang, Fu and Zheng, 2009).

However, there are also risks of human exposure to pathogens originating from the poultry slaughtering, processing, storage, handling and preparation phases. Poultry can be contaminated with harmful infectious agents, and raw poultry products are reported to be responsible for a significant number of cases of human food poisoning.

During these phases, controlling the contamination of carcasses by such pathogens presents a considerable challenge, especially in small-scale operations. In tropical countries, the ambient temperature is usually above 20°C, with a high degree of humidity creating favourable conditions for the multiplication of most bacteria. During the hot season, increased numbers of bacteria are found on poultry carcasses.

To quantify the food safety risks along the production and marketing chain, it is important to know how, where and when contamination with microorganisms occurs. Once this is known, it is possible to introduce risk reduction measures. The adoption of improved technology and strict hygiene measures can often reduce the risk of contamination of carcasses. The slaughtering facility must be divided into at least three separate sections: a live birds' area; a slaughtering area, including defeathering; and a processing area, starting with evisceration. To reduce the risk of pathogens multiplying on carcasses, poultry meat and carcasses should be refrigerated or consumed immediately after slaughter.

The native microflora of processed poultry is composed of many types of bacteria and yeasts, most of which are part of the microflora of live poultry. This microflora is carried into the processing facility on the body and in the intestines of the birds. For example, the bacteria *Campylobacter* spp. and *Salmonella* spp. inhabit the intestines of healthy birds, and can cause disease in humans, depending on their pathogenicity and the number and concentration of bacteria on the product. The sum of these factors will determine whether the consumer is at risk at the time of consumption.

The cleaner the birds are when they arrive at the slaughter place, the fewer the bacteria on their carcasses during slaughtering. On many farms, it is difficult to achieve low bacterial counts on the skin and feathers of birds, so emphasis should be placed on hygiene at the slaughter line.

LARGE-SCALE COMMERCIAL SLAUGHTERHOUSES

In modern large-scale slaughter plants, appropriate equipment is used and there are strict procedures for minimizing contamination. Nearly all procedures are automatic, and birds' contact with surfaces or poultry workers is kept to a minimum; for example, the carcasses are scalded in a counter-flow system, with the water flowing from clean to dirty, in the opposite direction to the birds. Automation enables the efficient control of hygiene, residues, etc. Although control systems are expensive, the large scale of operations means that this expense will have only a marginal effect on the prices of final products. These technical solutions and controls ensure delivery of a very safe product. If the processed carcasses are kept refrigerated and delivered rapidly to the supermarket, and kept there under appropriate temperatures, the consumer can be assured of buying a safe poultry product.

SMALL-SCALE SLAUGHTERING FACILITIES

In small-scale slaughtering facilities, birds are killed and then scalded in hot water. The carcasses are then plucked and eviscerated, mostly by hand. Before and after evisceration, carcasses are often washed, which may contribute to the dissemination of bacteria on and among carcasses. Further down the marketing chain, trussed birds are often displayed on shelves at ambient temperatures until they are sold. Unsold birds may be put into a refrigerator overnight.

When ambient temperatures are moderate to high (above 20°C) the microorganisms will multiply quickly, resulting in rapid deterioration of the meat's quality and safety, if the products are not cold-stored.

Traditional slaughtering during the hot season has been found to result in a significantly increased incidence of bacterial flora on poultry carcasses (Cohen et al., 2007). When carcasses are properly cooled (at 4 to 10°C), the growth of pathogens slows down.

REDUCING CONTAMINATION OF POULTRY CARCASSES IN SMALL-SCALE SLAUGHTERING FACILITIES

Birds to be slaughtered should be clean and dry; the cleaner they are the less contaminated their carcasses and meat will be (Bolder, 2007). To avoid the soiling of feathers with faeces, crates for

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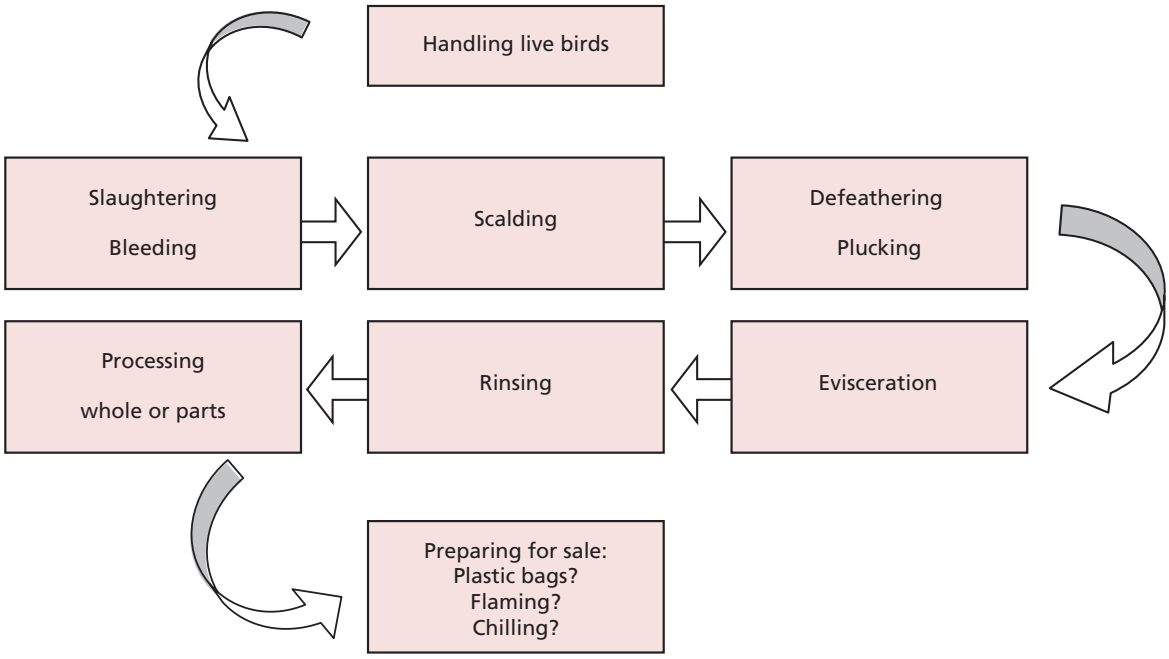
FIGURE 1
Steps in small-scale slaughtering



transporting poultry should not be stacked on top of each other, unless there are solid partitions between them.

The people slaughtering the birds should take precautions, by washing their hands frequently and avoiding the splashing of blood on to their face and clothes.

Placing the birds into cones for slaughter prevents the spread of microorganisms, because it prevents the birds from flapping during **bleeding**. The spreading of feathers during the slaughter process is also reduced, and hygiene is improved. Blood, which can contain pathogens, is collected in the trough beneath the cone and will not be splashed.

Photo Credit: Ineke Puls

Fixation in funnels during bleeding to prevent spread of micro-organisms

Commercial poultry processing plants defeather carcasses mechanically, after the feathers have been loosened by scalding (Arnold, 2007). **Scalding** involves immersing the carcasses in hot water (for four minutes at 50 to 58°C, or by dipping several times in water at 65°C), to loosen the feathers from the skin. In small-scale operations, this scalding is often done in a cooking pan. An under-scalded carcass will be difficult to pluck, while an over-scalded one will show torn skin or cooked flesh. Harmful bacteria and viruses can survive the scalding process. In some cultures, birds are scalded in boiling water. This reduces the risk of spreading viruses, but may cook the flesh. The quality and temperature of the scalding water are critical in determining the final degree of carcass contamination. The water should be frequently replaced.

Cross-contamination among carcasses is an important problem during the **defeathering** process. Mechanical defeathering equipment work centrifugally; the carcasses are rotated and the feathers are rubbed off by rubber fingers. Carcass contamination can occur through:

- direct contact between contaminated and uncontaminated carcasses;
- compression of the carcass, resulting in expulsion of internal faeces to the carcass surface;
- the mechanical fingers;
- contaminated feathers remaining in the plucker.

At **evisceration**, the vent is opened, the internal organs are removed, and the gizzard, liver and heart may be harvested. Carcasses can be contaminated through spillage of the contents of the intestines.

Photo Credit: Centre For Livestock and Agriculture Development (Celagrid)

Mechanical fingers should be renewed regularly, as cracked and worn fingers can harbour bacteria

Photo Credit: Copyright 2008, Charlotte Observer / MCT

Hanging is hygiene!

The contamination of carcasses and meat with poultry bacteria is not the only health risk to humans; the bacteria carried by poultry workers can also be transferred to the carcasses and subsequently to consumers. *Staphylococcus aureus* is a bacterium of particular concern here. Where evisceration is done by hand, as in traditional slaughter places, there is a potentially serious risk of contamination with these bacteria. Infrequent hand-washing exacerbates the problem. The primary factor contributing to staphylococcal food poisoning outbreaks is inadequate control of temperature after slaughter, with the initial contamination often being traced to poor personal hygiene by food handlers. If slaughter is followed by storage at temperatures that permit bacterial growth and multiplication, toxins will be produced. Staphylococcal toxins are noted for their heat resistance, and typically they cannot be inactivated by the normal heat processing of food (Cohen *et al.*, 2007). This means that once the toxins are present in the uncooked meat, people will get sick even from thoroughly cooked food.

Where carcasses are **rinsed** (with a shower or spray), the water used should be of drinking quality. Washing with cold water reduces the quantity of microorganisms on the carcass in the slaughter process.

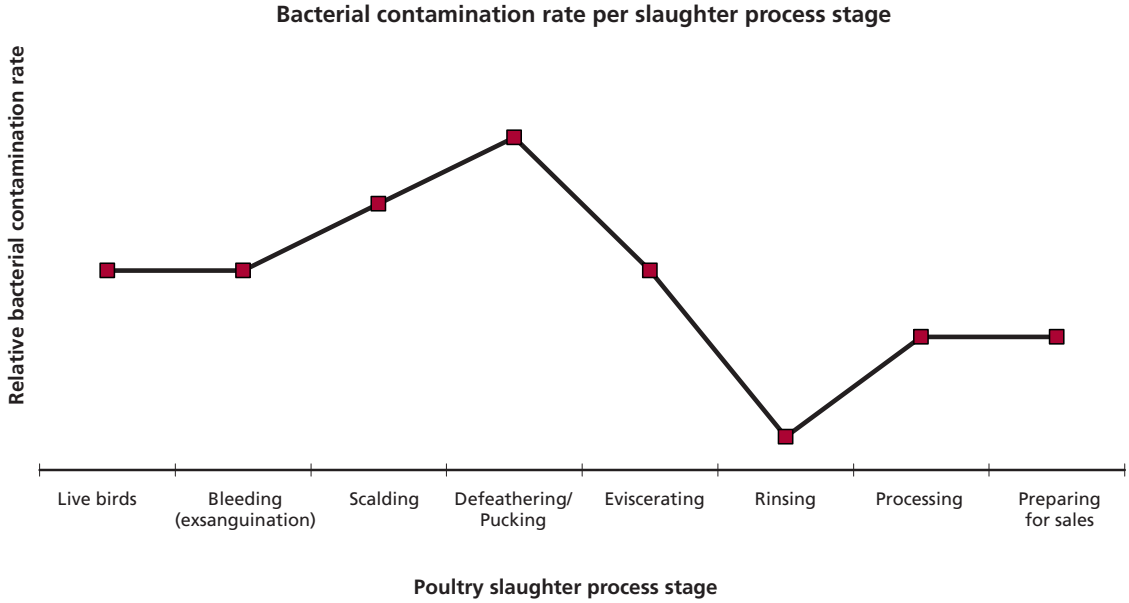
For good hygiene, and to wash away all the dirt and bacteria, etc., a regular supply of clean water is essential. Water should also always be available for personal hygiene and the cleaning of knives and other utensils. Water quantity and quality determine the level of hygiene.

Cross-contamination of carcasses can occur on working tables, sinks or draining boards during **processing**. The best way of preventing contamination of clean carcasses is to hang the birds. Abattoir workers handling the carcasses and contaminated knives can also act as vectors for the cross-contamination of carcasses.

When **preparing for sale**, bird carcasses are sometimes put into plastic bags, which prevent further carcass contamination. In

FIGURE 2

The contribution of each stage of the slaughter process to bacterial contamination



Source: Logue and Nde, 2007.

other cases, the surface of the carcass is flamed, which is a good method for reducing the number of bacteria contaminating the carcass. Quick chilling at 4 to 10° C is the best way of preventing bacterial growth.

REDUCING CONTAMINATION FROM BY-PRODUCTS AND WASTES

Feathers, especially from ducks and geese, are used for duvets and clothing. Feathers for trade are pasteurized, which kills most viruses, including H5N1 HPAI virus, and leaves the product safe (Beato, Capua and Alexander, 2009).

Poultry slaughter waste, such as carcasses, blood, feathers and offal, should be properly disposed of. It can contain viruses, bacteria and residues. In resource-poor areas, burning or burial are the most likely, practical and effective methods for disposing of waste (Nicholson, Groves and Chambers, 2005).

COMMUNICATION FOR BEHAVIOURAL CHANGE

Recently, biosecurity and good hygiene measures have been promoted more intensively in many places, in response to the risk of influenza H5N1 infection in humans. The training of trainers, workers at slaughter facilities and producers themselves helps reduce the risk of exposure.

FURTHER READING

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