Hygiene control in pig processing

SUMMARY

This article summarises the role played by the various stages of pig processing, including the farm, transport, lairage, abattoir and butchering room stages, that lead to the final contamination of the pork carcass. It provides an overview of the critical points involved in the spread of the pathogen Salmonella and the control measures available to help minimise its spread.

The control principles described, including the adoption of good cleaning and disinfection practices, could be applied to many raw meat processes to help reduce the overall risk of microbial contamination to the final raw product.
Background - Salmonella, Pigs and Human Salmonellosis

Salmonella are Enterobacteriacea bacteria that are carried by some animals, including pigs, and which can be transmitted through water, soil, animal feces and gut contents, raw meats, and eggs.

Pigs have been found to be the predominant animal reservoir for Salmonella (Cantoni & Bersani, 2010). Salmonella in pigs is found mainly in the intestines, lymph nodes and tonsils. The EFSA survey, published in 2008 (EFSA, 2008a) found that an average of 10.3% of pigs at slaughter were positive for Salmonella from these sources. They also investigated external carcass contamination and found an average prevalence of 8.3%. Of the Salmonellas found Salmonella Typhimurium and Salmonella Derby represented 40% and 14% of these respectively (EFSA 2008a). These Salmonellas are the same as those often found in cases of human infection. Consequently, there is now increasing focus on reducing the prevalence of Salmonella contamination on pig meat as a means of reducing human infection.

Salmonellosis is a foodborne illness caused by the Salmonella bacteria. Salmonella infections in humans typically affect the intestines, causing vomiting, fever, and other symptoms that usually resolve without medical treatment.

The main risk factors leading to the contamination of pork with Salmonella are 1) infected herds, 2) poor hygiene standards at all stages of pork processing, and 3) poor cross-contamination control.

Salmonella Cross-Contamination Within Pig Processing

There are a number of stages at which Salmonella can spread within pork processing:

- At the farm – here the focus should be on the rearing of Salmonella-free pigs. Poor hygiene has been identified as one of the most important risk factors for high salmonella prevalence in positive herds. Investigation of the Danish pig industry showed that even a relatively low prevalence of Salmonella in primary production can result in a high numbers of contaminated carcasses at the slaughterhouse-level.

  - During transport – Transport vehicles are rarely cleaned adequately between loads and consequently can become highly contaminated with organic matter and biofilms as a result of anal evacuations, encouraged by fasting and the transportation stress, by infected pigs.

  - During lairage – Similarly, build up of contamination in the lairage and cross-contamination between infected and Salmonella-free animals can lead to the spread of Salmonella. The majority of the studies carried out conclude that lairage pens represent a very important source of infection for the pigs housed in them and that contamination of the environment by the infected pigs contributes to the spread of the infection to the healthy pigs. Initial infection of the tonsils of a Salmonella-free animal can spread, via the lymph, to reach the colon and rectum in <3 hours (Fedorka-Cray et al. 1994). Also, the lairage cleaning and disinfection protocols are very ineffective. The Salmonella strains found in the lairage pens have been frequently related to the strains present in the carcasses.

  - In the slaughterhouse – The slaughterhouse environment is probably the major source for Salmonella infections (Fedorka-Cray et al. 1994; Hurd et al. 2001a&b; Swanenburg et al. 2001). Final carcass contamination rates in the abattoir have been found to be seven times higher than those on the farm and 50% of the carcasses contaminated by Salmonella were due to cross-contamination. This contamination of the environment is attributed to anal leakage and gut rupture after evisceration.
These events can lead to subsequent cross-contamination of neighbouring carcasses and equipment by splash and handling, and cross-contamination via contact with infected surface after scalding and singeing.

- At the cutting stage through to retail – To the pork via cross-contamination from hands, equipment and surfaces, and as a result of slow or inadequate chilling that allows bacterial proliferation.

A study in a small slaughterhouse in Ireland measured the number of Salmonella on pig carcasses (Bolton et al., 2002). The sampling was performed at different stages of pig processing. Salmonella spp. on pigs at the farm was 27%, decreasing to 10% after pre-slaughter washing, but increasing again to 50% following stunning and bleeding. Hair removal (i.e. scalding, de-hairing and singeing) resulted in a significant decrease in viable bacterial counts but significant increases were observed after pre-evisceration washing and final chilling.

**CONTROL OF SALMONELLA WITHIN PIG PROCESSING**

Following the introduction of a Salmonella control program in Denmark in 1995, extensive research into the risk factors associated with Salmonella in pig processing has been conducted, and a series of intervention factors have been developed. In particular:

- The separation of Salmonella-free and infected animals, and the thorough cleaning and disinfection of the environment and equipment used between rearing, transport, lairage, slaughter and butchering of these two groups, at all stages is recommended.

- The adoption of Hazard Assessment of Critical Control Points (HACCP) procedures.

- The hygienic design (clean ability) of transport vehicles, buildings and equipment used for pig processing – these should allow easy and practical access to all contaminated areas and be made of smooth, washable, impermeable, chemical resistant, non-toxic durable materials.

- Staff hygiene training - the skills and attitude of the butchers, slaughter men and meat handlers can impact considerably on the overall quality of the product and they should be provided with the facilities and training to ensure adherence to personal hygiene and proper slaughtering and meat transport.
The use of automatised slaughter lines – these lower the risk of carcass surface contamination by ensuring that carcasses don’t come into contact with the floor, as floors are among the most contaminated surfaces in the slaughterhouse. and reduce the manual activities associated with the surface of the carcass, e.g. removal of abdominal fat or condemned parts of the carcass, which are largely responsible for the spreading of Salmonellas as the tools and hands of the workers get contaminated easily and result in cross-contamination of the carcass. If manual operations are employed the tools used should be cleaned frequently, by immersion in water at ~82°C, and staff should be trained in personnel hygiene practices including good hand hygiene and frequent changing of gloves.

Correct evisceration without piercing or tearing the intestines - key to avoiding the spread of the contamination.

Hot water carcass rinsing – has been shown to significantly reduces carcass contamination (Gill et al., 1995; 1997)

Rapid carcass chilling is critical to minimise bacterial proliferation (Spescha et al., 2006).

Cleaning of the tools and working surfaces in the butchering room - to eliminate organic matter in the saws and de-rinders throughout the day (clean as you go) and with a deep clean at the end of the day. Staff should be trained in personnel hygiene practices including good hand hygiene and frequent changing of gloves.

Microbiological sampling at all stages as an indication of process hygiene and the presence of Salmonella. Positive results should trigger review and amendment of hygiene practices.

Additional practices, including anal bunging before scalding, optimisation of scalding and singeing at ~63°C (to ensure bacterial inactivation but prevent skin lesions), regular changing of scald tank water, and decontamination of de-hairing machines, which can re-contaminate the carcasses with accumulated organic matter containing Salmonellas, should also be considered.

**CLEANING AND DISINFECTION IN PIG PROCESSING**

Key to the control of microbial cross-contamination from the environment to the pig carcass is regular and effective cleaning and disinfection. “Cleaning” refers to the removal of debris, such as dirt, fat and protein particles, and microorganisms from surfaces, walls, floors, tools and equipment. In raw meat processing cleaning, can be achieved in a number of different ways including:

- Manual dry cleaning
- Manual wet cleaning
- High-pressure wet cleaning – Not recommended as these create aerosol clouds and spread water droplets (and thus contamination) over great distances.
- Use of cleaning chemicals (detergents). These can be used in conjunction with wet cleaning methods.
Vikan provide a comprehensive range of manual cleaning tools that can be used for effective dry and wet cleaning.

Amongst the most popular manual tools used for slaughterhouse cleaning are the:

- Short handled hand brush (Product code 4190x/4192x),
- Hand brush (3890x),
- Wall/floor brush (7060x),
- Aluminium handle, 1300/1500 mm (2935x/2937x),
- Single blade squeegees (7140x-7170x),
- Double lip hygiene squeegees (7712x-7725x),
- Cell rubber squeegees (7752x-7755x),
- Shovels (5600x, 5601x, 5610x and 5611x),
- Cleaning equipment wall brackets (1017x 1018x)
- High Low brush (7047x)
- Deck scrub (7041x)

Additionally, Vikan offer a range of manual cleaning tools specifically designed for transport decontamination.

Please visit the Vikan website (www.vikan.com) for further information.

Cleaning should be followed by disinfection. “Disinfection” is the inactivation and removal of microorganisms on surfaces, floors and tools to an acceptable level. Disinfection is achieved either by using hot water (or steam) or chemical disinfectants. Chemical disinfectants are the preferred option in the meat industry.

Cleaning is a vital pre-cursor to disinfection, as any organic matter remaining on the surface will absorb the disinfectant and act as a barrier to prevent effective disinfection of the surface.

Consequently, it is essential that the equipment and methods used to clean the surfaces are effective. The growth and accumulation of Salmonella in the environment will be related to the ambient temperature. Consequently, in the summer, all areas should be cleaned and disinfected more regularly.

The control principles described, including the adoption of good cleaning and disinfection practices, could be applied to many raw meat processes to help reduce the overall risk of microbial contamination to the final raw product.
REFERENCES


