

DRAFT CHAPTER 6.X.

**PREVENTION AND CONTROL OF *SALMONELLA*
IN PIG HERDS**

Article 6.X.1.

Introduction

Nontyphoidal salmonellosis is one of the most common food-borne bacterial diseases in the world with *Salmonella* Enteritidis and *S. Typhimurium* the predominant serotypes identified in most countries.

As is the case in most food producing *animals*, *Salmonella infection* in pigs is mostly subclinical and of variable duration. Pigs with subclinical *infection* play an important role in the spread of *Salmonella* between *herds* and pose a public health risk.

Salmonella serotypes and their prevalence in pigs may vary considerably between farms, regions and countries. It is important for *Veterinary Authorities* to consider the serotypes and their prevalence in pig populations when developing and implementing *Salmonella* reduction strategies.

Article 6.X.2.

Purpose and scope

To combat the occurrence of food-borne salmonellosis, a pre-harvest pathogen reduction strategy can assist in reducing the presence of *Salmonella* in pig *meat*.

This chapter provides recommendations on the prevention and control of *Salmonella* in domestic pigs kept for commercial breeding and production from farm to slaughter. It should be read in conjunction with the Codex Alimentarius Guidelines for the Control of Nontyphoidal *Salmonella* spp. in Pork Meat (under development) and the Codex Alimentarius Code of Hygienic Practice for Meat (CAC/RCP 58-2005).

Article 6.X.3.

Surveillance in pig herds for *Salmonella*

Where justified by *risk assessment*, *surveillance* should be carried out to identify the occurrence and distribution of *Salmonella* in pig *herds*. *Surveillance* data will provide information to assist the *Competent Authorities* in their decision making regarding the requirement for, and design of, control programmes. Sampling and testing methods, frequency and type of samples required should be determined by the *Veterinary Services* based on the *risk assessment*.

Serological testing, usually using 'meat juice' at slaughter, is a common method for assessing exposure to *Salmonella* in pig *herds*. Benefits of serological testing include low cost per test, high throughput capability and the potential for automation of tests. Collection of samples at the *slaughterhouse/abattoir* enables centralised sampling of multiple *herds*. Serological testing does not detect exposure to all serotypes and does not provide information on the serotypes present.

Annex XXIII (contd)

Microbiological testing identifies serotypes present in pig *herds* and can provide epidemiological information on likely sources of *Salmonella* and on the presence of strains with higher public health risk, including those with enhanced virulence or resistance to *antimicrobial agents*. Bacteriological sampling of individual pigs has low sensitivity but this can be overcome by repeated sampling, by pooling of samples (such as individual faecal samples or mesenteric lymph nodes) or sampling naturally pooled material (such as sampling of faeces from the floor of pig pens).

Communication of the results of post-mortem *Salmonella* testing that are relevant to the *Salmonella* status of pigs at *herd* level to the *herd* manager or *veterinarian* is an important element of a *Salmonella* control programme.

Article 6.X.4.

Definitions

Feed: means any material (single or multiple), whether processed, semi-processed or raw, which is intended to be fed directly to terrestrial *animals* (except bees).

Feed ingredient: means a component part or constituent of any combination or mixture making up a feed, whether or not it has a nutritional value in the *animal's* diet, including feed additives. Ingredients are of plant (including aquatic plants) or terrestrial or aquatic animal origin, or other organic or inorganic substances.

Article 6.X.5.

Prevention and control measures

Articles 6.X.6. to 6.X.14. provide recommendations for the prevention and control of *Salmonella* at *herd* level. Contamination of pig *meat* can be reduced by measures taken during the *slaughter* process. Reduction of *Salmonella* in pigs entering the *slaughterhouse/abattoir* enhances the effectiveness of such measures.

These recommendations will also have beneficial effects on the occurrence of other *infections* and *diseases*.

Article 6.X.6.

Biosecurity measures

It is important to have biosecurity measures in place to reduce the risk of introduction of *Salmonella* or the entry of new strains of *Salmonella* into pig *herds*, the spread of these strains across the *herd*, as well as to minimise prevalence of existing strains.

It is recommended that biosecurity measures include the following:

- 1) Development and implementation of a *biosecurity plan* including management strategies for the prevention and control of *Salmonella*.
- 2) Training of personnel regarding their responsibilities and the significance of their role in improving animal health, human health and food safety.
- 3) Maintenance of records including data on pig health, production, movements, medications, *vaccination*, mortality, *surveillance*, and cleaning and *disinfection* of farm buildings and equipment.
- 4) Veterinary supervision of pig health and *Salmonella* control.
- 5) Removal of unwanted vegetation and debris that could attract or harbour pests around pig housing.
- 6) Prevention of entry of wild birds into pig houses and buildings.

- 7) Cleaning and *disinfection* procedures for pig housing, general equipment, transportation equipment and animal walkways. The cleaning and *disinfection* procedures for pig housing after emptying should include at least feeders, drinkers, floor, walls, aisles, partitions between pens, and ventilation ducting. All visible organic material should be removed before *disinfection* with a suitable *disinfectant* at an effective concentration. *Disinfectants* should be used in accordance with Chapter 4.13.
- 8) Procedures for the control of vermin such as rodents and arthropods should be in place and regular checks should be carried out to assess effectiveness. When the presence of vermin is detected timely control actions should be taken to prevent the development of unmanageable populations; for example, the placement of baits for rodents where they are nesting.
- 9) Controlled access of persons and *vehicles* entering the *establishment*.
- 10) Biosecurity measures applied to all personnel and visitors entering the *establishment*. This should include hand washing and changing into clean clothes and footwear provided by the *establishment*. Similar precautions are recommended when moving between separate *epidemiological units* on large farms.
- 11) *Vehicles* and equipment identified as a *risk* in the *biosecurity plan* should be cleaned and *disinfected* before entering the *establishment*.
- 12) Pig carcasses, bedding, faeces and other potentially contaminated farm waste should be stored and disposed of in a safe manner to minimise the risk of dissemination of *Salmonella* and to prevent the direct or indirect exposure of humans, livestock and *wildlife* to *Salmonella*. Particular care should be taken when pig bedding and faeces are used to fertilise horticultural crops intended for human consumption.

Article 6.X.7.

Facility design

Good design of pig units facilitates the management and control of pathogens.

It is recommended that facility design consider the following:

- 1) location of other livestock *establishments* in relation to wild bird and rodent populations;
- 2) adequate drainage for the site and control of run-off and untreated waste water;
- 3) use of smooth impervious materials for construction to enable effective cleaning and *disinfection*;
- 4) surrounding indoor pig houses with concrete or other impervious material to facilitate cleaning and *disinfection*;
- 5) a controlled entry point to prevent the entry of unwanted *animals* and people;
- 6) a sign indicating restricted entry at the entrance to the *establishment*;
- 7) pig flow to minimise stress and spread of *Salmonella infection*;
- 8) prevention of entry of wild birds, rodents and *feral animals*;
- 9) location of delivery and collection points away from pig housing or feed storage.

Article 6.X.8.

Feed

Salmonella contaminated feed and feed ingredients are known to be important sources of *infection* for pigs. Therefore, feed and feed ingredients should be produced, handled, stored, transported and distributed according to Good Manufacturing Practices, considering Hazard Analysis Critical Control Points (HACCP) principles and recommendations in accordance with Chapter 6.3.

For the effective control of *Salmonella* it is recommended that:

- 1) Feed and feed ingredients should come from monitored sources.
- 2) Heat treated feeds are used and may also include the addition of bactericidal or bacteriostatic treatments, e.g. organic acids. Where heat treatment is not possible, the use of bacteriostatic or bactericidal treatments or processes should be considered.
- 3) Cooling systems and dust control in feed ingredient processing plants and compound feed mills should be managed to avoid recontamination of feed and feed ingredients with *Salmonella*.
- 4) Feed should be stored and transported in a hygienic manner that prevents exposure to possible residual *Salmonella* contamination.
- 5) Access to feed by wild birds and rodents should be prevented.
- 6) Spilled feed should be cleaned up immediately to remove attractants for wild birds, rodents and other pests.

Article 6.X.9.

Water

For the effective control of *Salmonella* it is recommended that:

- 1) The drinking water supply should be monitored and controlled to maintain it free from *Salmonella* contamination.
- 2) Water holding tanks are enclosed.
- 3) The water delivery system is regularly cleaned and disinfected. For example in an 'all-in-all-out' system this would occur before restocking.

Article 6.X.10.

Feed composition

For the control of *Salmonella* it is recommended that the following be considered when determining feed composition:

- 1) Slower gastric transit time of ingested feed increases exposure of *Salmonella* to stomach acid resulting in decreased survival.
- 2) Modified fermentation conditions in the gastrointestinal tract may enhance colonisation by protective bacteria and thereby suppress the colonisation and multiplication of *Salmonella*.
- 3) Liquid feed that is fermented has a protective effect due to the presence of beneficial bacteria and low pH levels; for example, the inclusion of fermented *milk products*.

Where *Salmonella* is present in a pig *herd*, the composition of feed may influence the occurrence of *Salmonella* in individual pigs. For the effective control of *Salmonella* it is recommended that:

- 4) Feed should be coarsely ground.
- 5) Where feed is wheat based, reducing the proportion of wheat may reduce the occurrence of *Salmonella* in pigs.
- 6) Coarsely ground material may be added to pelleted feed.

Article 6.X.11.

Pig flow management

The movement and mixing of pigs increase the risk of spread of *Salmonella*. For the effective control of *Salmonella* it is recommended that:

- 1) The number of pig movements and mixing of pigs between weaning and dispatch for *slaughter* should be minimised.
- 2) If possible, the 'all-in-all-out' single age group principle should be used. In particular, the addition to younger groups of pigs held back from older groups should be avoided.

Article 6.X.12.

Management of new pig introductions

To minimise the risk of new introductions of *Salmonella* in replacement pigs in a *herd*, it is recommended that:

- 1) There is good communication along the pig production chain to ensure that steps are taken to minimise the introduction and dissemination of *Salmonella*.
- 2) A closed *herd* policy is applied with the introduction of new genetic material by semen only.
- 3) The number of separate sources for both replacement breeding stock and rearing pigs are as few as possible.
- 4) Newly introduced pigs are kept separate from the rest of the *herd* for a suitable period before incorporating with other pigs, e.g. four weeks.
- 5) Replacement breeding pigs are of a similar *Salmonella* status to that of the *herd*, for example a *Salmonella* free *herd* should source replacements from *Salmonella* free *herds*; or *herds* that are free of specific *Salmonella* serotypes such as *S. Typhimurium* should avoid introducing pigs from breeding *herds* infected with such serotypes.
- 6) Where appropriate, pooled faecal samples from introduced pigs are taken to assess their *Salmonella* status.

Article 6.X.13.

Stress reduction

Given that stress may increase the multiplication and shedding of *Salmonella* by pigs and their susceptibility to *infection*, it is important to consider management measures that reduce stress.

Article 6.X.14.

Pig treatments

- 1) *Antimicrobial agents* may modify normal flora in the gut and increase the likelihood of colonisation by *Salmonella*. If *antimicrobial agents* are used for the control of clinical *infections* in pigs, they should be used in accordance with Chapters 6.7., 6.8., 6.9. and 6.10.

Antimicrobial agents should not be used to control subclinical *infection* with *Salmonella* in pigs because the effectiveness of the treatment is limited and can contribute to the development of antimicrobial resistance.

- 2) *Vaccination* may be used as part a *Salmonella* control programme. Vaccine production and use should be in accordance with Chapter 2.9.9. of the *Terrestrial Manual*.

Vaccines for *Salmonella* in pigs may increase the threshold for *infection* and reduce the level of excretion of the organism. The protective effect of vaccines is serotype specific and few licensed vaccines are available for pigs.

If serology is used as the *surveillance* method, it may not be possible to distinguish between *vaccination* and *infection* with a field strain.

If live vaccines are used:

- a) it is important that field and vaccine strains be easily differentiated in the laboratory;
 - b) the vaccine strain should not be present at the time of *slaughter*.
- 3) Organic acids, probiotics and prebiotics may be added to feed or water to reduce shedding of *Salmonella* by pigs. However, efficacy is variable.

Article 6.X.15.

Transportation

The relevant recommendations in Chapter 7.3. apply.

Article 6.X.16.

Lairage

Lairage can be used at various stages in pig production, for example accumulation of weaned pigs before movement to nursery *herds*, holding finisher pigs before transport to *slaughter* and holding pigs at the *slaughterhouse/abattoir* before *slaughter*. Important aspects of *lairage* management include effective cleaning and *disinfection* between groups, minimising mixing of separate groups and managing stress.

In addition, the relevant recommendations in Articles 7.5.1., 7.5.3., and 7.5.4. apply.

Article 6.X.17.

Prevention and control in low prevalence regions

In regions where *Salmonella infection* of pigs is uncommon it may be possible to eliminate *infection* from individual *herds* by means of a test and removal policy. This can be accomplished by placing movement controls on the *herd*, repeated bacteriological sampling of groups of pigs and culling of persistently infected pigs. Movement controls can be lifted after two rounds of negative tests and confirmation of implementation of effective prevention and control measures as described in Articles 6.X.5. to 6.X.14.

It may be possible to attempt this approach in individual *herds*, for example in valuable breeding *herds*, in higher prevalence regions. However, the risk of reintroduction of *infection* must be low to achieve success with this approach.

Article 6.X.18.

Outdoor pig production

As far as possible the prevention and control measures described in Articles 6.X.5. to 6.X.14. should also be applied to outdoor pig production to reduce *Salmonella infection* in pigs. It is recommended that:

- 1) field rotation programmes be used to minimise *Salmonella* contamination and accumulation in soil and surface water and therefore ingestion by pigs;
- 2) feed be provided using troughs or bird proof hoppers to minimise attraction of wild birds;
- 3) location of other outdoor pig *herds* and the concentration and behaviour of wild birds in the area be considered when establishing outdoor pig *herds*.

Article 6.X.19.

Live animal markets

Live animal markets pose a significant risk of spreading *Salmonella* and other *infections* and *diseases* among pigs. If possible, sourcing replacement pigs from live animal markets should be avoided. Precautions should be taken to prevent the spread of *Salmonella* from markets to pig *herds* by personnel or *vehicles*.
