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DRAFT CHAPTER 6.X.

PREVENTION AND CONTROL OF SALMONELLA IN COMMERCIAL CATTLE BOVINE PRODUCTION SYSTEMS

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Article 6.X.1.

Introduction

Nontyphoidal salmonellosis is one of the most common foodborne bacterial diseases in the world with Salmonella Enteritidis and S. Typhimurium (including monophasic variants) being the predominant serotypes identified in humans in most countries. S. Enteritidis is primarily associated with poultry while S. Typhimurium may be present in many mammalian and avian hosts. In addition, these serotypes and several others occur at variable prevalence in cattle depending on the region. In some countries S. Dublin and S. Newport may also cause salmonellosis in humans; limited number of other serotypes associated with cattle may cause salmonellosis in humans, for example, S. Dublin and S. Newport.

As is the case in most food-producing animals, Salmonella infection in cattle is mostly subclinical, although clinical disease such as enteritis, septicaemia or abortion can occur. Subclinical infection can be of variable duration including a carrier state, can be of variable duration and can play an important role in the spread of Salmonella within and between herds and pose a public health risk.

Herd size and stocking density may influence the risk likelihood of introduction, dissemination or persistence of Salmonella; however, this is also dependent on geographical region, husbandry and other factors such as season and age.

Salmonella serotypes and their prevalence in cattle may vary considerably within and between farms, countries and regions. It is important for Veterinary Authorities and producers to consider serotypes of Salmonella, their occurrence and the disease burden in cattle and human populations when developing and implementing strategies for the prevention and control of Salmonella in commercial cattle production systems.

Article 6.X.2.

Definitions

For the purposes of this chapter:

Commercial cattle production systems: means those systems where the purpose of the operation includes some or all of the following: breeding, rearing and management of cattle for the production of meat and meat products or milk and milk products.

Intensive cattle production systems: means commercial systems where cattle are in confinement and are fully dependent on humans to provide for basic animal needs such as food, shelter and water on a daily basis.

Extensive cattle production systems: means commercial systems where cattle have the freedom to roam outdoors, and where the cattle have some autonomy over diet selection (through grazing), water consumption and access to shelter.

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.
Semi-intensive cattle production systems: means commercial systems in which cattle are exposed to any combination of both intensive and extensive husbandry methods, either simultaneously or variably according to changes in climatic conditions or physiological state of the cattle.

Article 6.X.3.

Purpose and scope

The purpose of this article is to provide recommendations for the prevention and control of Salmonella in commercial cattle bovine production systems in order to reduce the burden of disease in cattle bovines and the risk of human illness through foodborne contamination as well as human infections resulting from direct or indirect contact with infected cattle bovines (e.g. via faeces or abortion material).

For the purposes of this chapter a bovine means Bos taurus, B. indicus, B. javanicus and B. grunniens, water buffaloes (Bubalus bubalis) and bison (Bison bison and B. bonasus).

This chapter applies to bovines cattle (Bos taurus, B. indicus, B. javanicus and B. grunniens), water buffaloes (Bubalus bubalis) and wood bison (Bison bison and B. bonasus) kept in commercial cattle bovine production systems.

This chapter should be read in conjunction with the Codex Alimentarius Code of Hygienic Practice for Meat (CAC/RCP 58-2005), and the Codex Alimentarius Code of Hygienic Practice for Milk and Milk Products (CAC/RCP 57-2004), Code of Practice on Good Animal Feeding (CAC/RCP 54-2004), and the Guidelines for the Control of Nontyphoidal Salmonella spp. in Beef and Pork Meat (CAC/GL 87-2016), and the OIE/FAO Guide to Good Farming Practices for Animal Production Food Safety.

Article 6.X.4.

Objectives of prevention and control measures

It is recommended that prevention and control measures be focused on those serotypes of Salmonella of greatest consequence to cattle bovines and public health. These measures will also contribute to the reduction of other serotypes.

Reduction of Salmonella in cattle in primary production may reduce the level of the pathogen:

1) entering the slaughterhouse/abattoir and therefore decrease the risk of beef contamination during slaughter and dressing procedures;

2) in milk and milk products;

3) in the farm environment, thereby reducing the risk of dissemination of Salmonella and contact infections in humans.
Prevention and control measures in commercial cattle bovine production systems may:

1) reduce the prevalence and amount of Salmonella entering the slaughterhouse/abattoir and therefore decrease the challenge to the slaughter and dressing procedures and the likelihood of bovine meat contamination;

2) reduce the likelihood of Salmonella contamination in milk;

3) reduce Salmonella contamination of the environment via cattle bovine faecal waste, which in turn will limit infection of animals (including wildlife);

4) reduce the likelihood of infections in humans through contact with infected cattle bovines or contaminated materials or water.

While control in the primary production phase can decrease the number of animals carrying or shedding Salmonella, controls after primary production are also important to minimise the contamination and cross-contamination of carcasses and meat products.

When appropriate, good farming practices and, when appropriate, the principles of hazard analysis and critical control points (HACCP) should be taken into account when designing prevention and control measures.

Articles 6.X.5. to 6.X.14. provide recommendations for the prevention and control of Salmonella in commercial cattle bovine production systems. These recommendations may also have beneficial effects on the occurrence of contribute to the prevention and control of some other infections and diseases.

Article 6.X.5. Biosecurity

Biosecurity is intended essential to assist with the prevention and control of Salmonella. A biosecurity plan should be developed according to the commercial cattle bovine production system employed. The applicability of the measures, described below, will vary according to the type of commercial cattle bovine production system.

When including Salmonella as part of a biosecurity plan the following should be addressed:

1) location, design and management of the establishment;

2) veterinary supervision of cattle bovine health;

3) management of the introduction and mixing of cattle bovines;

4) training of personnel in their responsibilities and their role in animal health, human health and food safety;

4bis) prevention of contamination of feed and water, including for irrigation;

5) maintenance of records including data on cattle bovine health, production, movements, feeding, water supply, medications, vaccination and mortality, and cleaning and disinfection of farm buildings and equipment;

6) availability of test results to the farm operator when Salmonella surveillance is conducted;

7) removal of unwanted vegetation and debris that could attract or harbour pests around cattle premises for bovines;

8) minimising the entry of domestic animals and wild birds into cattle buildings for bovines and feed stores;

9) cleaning and disinfection procedures for buildings in which cattle bovines are handled or housed in accordance with Chapter 4.13.
10) control of pests such as rodents and arthropods and regular assessment of effectiveness;
11) control and hygienic procedures for entry and movement of persons and vehicles;
12) cleaning and disinfection of equipment and vehicles identified as posing a risk;
13) storage and disposal of dead animals, bedding, faeces and other potentially contaminated farm waste in a manner that minimises the likelihood of dissemination of Salmonella and prevents the direct or indirect exposure of humans, livestock and wildlife to Salmonella. Particular care should be taken when cattle bedding and faeces of bovines are applied to land used for horticultural crops intended for human consumption;
14) procedures for prevention of dissemination of Salmonella when an animal is suspected or known to be infected.

Article 6.X.56.

Location and design of establishments for bovines cattle establishment

When making decisions on the location and design of cattle establishments for bovines, it is recommended that mitigation reduction of the risk likelihood of transfer of pathogens pathogenic agents, including Salmonella, from major sources of contamination be considered. Sources of Salmonella may include other livestock establishments or areas of application or disposal of contaminated waste or effluent. Transfer Other sources and vectors of Salmonella between establishments may involve carriage by include vehicles, equipment, water-courses, persons-personnel, domestic animals, wild birds, rodents, flies and other wildlife.

It is recommended that the The design of intensive cattle bovine production systems should consider the following:

1) management of faecal waste to minimise contamination of the establishment;
2) adequate drainage for the site and control of run-off water and untreated waste water;
3) use of materials for construction that facilitate effective cleaning and disinfection;
4) control of the points of entry and movement of vehicles, equipment and persons;
5) preventing contamination of feed and water during storage and distribution;
6) cattle handling and movements of bovines to minimise stress and spread of Salmonella infection;
7) separation of cattle bovines according to likelihood of different infection with, or susceptibility to, Salmonella risk status;
8) restriction of entry of domestic animals, wild birds, rodents, flies and other relevant wildlife.

In extensive cattle bovine production systems, location and design options may be limited; however, applicable biosecurity measures should be considered.
Article 6.X.6.

Biosecurity management plan

Biosecurity measures that include management and physical factors designed to reduce the risk of introduction, establishment and spread of animal diseases, infections or infestations to, from and within an animal population would also be expected to assist with the prevention and control of Salmonella.

When developing a biosecurity management plan it is recommended that the following be taken into consideration:

1) Veterinary supervision of cattle health.
2) Management of introduction and mixing of cattle.
3) Training of personnel in their responsibilities and their role in animal health, human health and food safety.
4) Maintenance of records including data on cattle health, production, movements, medications, vaccination, and mortality, and cleaning and disinfection of farm buildings and equipment.
5) Availability of test results to the farm operator when Salmonella surveillance is conducted.
6) Removal of unwanted vegetation and debris that could attract or harbour pests around cattle premises.
7) Minimising the entry of wild birds into cattle buildings and feed stores.
8) Cleaning and disinfection procedures for buildings in which cattle are handled or housed. For example, the cleaning and disinfection procedures for intensive calf housing, calving areas and sick pens after emptying may include feeders, drinkers, floor, walls, aisles, partitions between pens, and ventilation ducting.
   When disinfectants are used they should be applied at an effective concentration after a complementary cleaning procedure.
9) Control of pests such as rodents and arthropods when required and regular assessment of effectiveness.
10) Control of persons and vehicles entering the establishment.
11) Cleaning and disinfection of vehicles and equipment identified as a risk.
12) Storage and disposal of cattle carcasses, bedding, faeces and other potentially contaminated farm waste 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 to be taken when cattle bedding and faeces are used as fertiliser for horticultural crops intended for human consumption.
Management of **cattle** introductions of **bovines** into the establishment

To minimise the risk likelihood of introducing *Salmonella* through cattle introductions of bovines, it is recommended that:

1. **There be good communication within the cattle bovine industry** should be encouraged to raise awareness of the risk likelihood of introducing *Salmonella* through cattle introductions.

2. **The number of separate sources of cattle for breeding or rearing** be kept to as few as possible. For example, in a closed dairy herd it is possible to introduce new genetic material solely by semen or embryos. **Consideration should be given to minimising the number of sources of replacement cattle bovines.**

3. **Introduction of new genetic material should be introduced through the use of semen and embryos be considered whenever practicable.**

4. **If possible, cattle bovines should be sourced directly from herds of origin** because live animal markets or other places where cattle bovines from multiple properties are mixed for resale may increase the risk likelihood of spread of *Salmonella* and other infectious agents among cattle bovines.

5. **Newly introduced cattle bovines should be kept separate from the rest of the herd** for a suitable period before mixing with other cattle bovines. E.g. four weeks.

6. **Where appropriate, pooled faecal samples from introduced cattle could be taken to assess their *Salmonella* status.**

7. **Where appropriate, testing of animals for *Salmonella* prior to introduction or mixing with other cattle bovines should be considered to inform subsequent control measures, for example, when introducing cattle bovines of unknown status.**

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**Article 6.X.8.**

**On farm cattle** Management of **bovines on farm**

To minimise reduce the risk likelihood of transferring *Salmonella* among cattle bovines, it is recommended that:

1. **Cattle bovines** with suspected salmonellosis or otherwise sick should be separated from healthy cattle bovines.

2. **Care of healthy cattle bovines should be carried out prior to care of cattle bovines** with suspected salmonellosis.

3. **Priority should be given to the hygienic management of calving areas,** for example keeping perinatal cattle bovines separated from sick cattle bovines and maintaining a clean environment.

4. **Cattle bovines should be segregated according to age:**

5. **When possible, the ‘all-in–all-out’ principle for production cohorts should be used.** In particular, the unnecessary mixing of different age groups during rearing, especially of calves, should be avoided.

6. **Consideration should be given to the potential for between-herd transmission of *Salmonella* via breeding, rearing and grazing of cattle bovines from multiple sources on a single site,** for example shared pasture, and heifer rearing, or sharing of bulls.

7. **Consideration should be given to the potential for between-herd transmission of *Salmonella* through direct contact between cattle bovines across boundary lines or indirectly, for example, through contamination of water courses.**
Article 6.X.7.

Management of cattle introductions of bovines into the establishment

To minimise the risk likelihood of introducing Salmonella through cattle introductions of bovines, it is recommended that:

1) There be good communication within the cattle bovine industry should be encouraged to raise awareness of the risk likelihood of introducing Salmonella through cattle introductions.

2) The number of separate sources of cattle for breeding or rearing be kept to as few as possible. For example in a closed dairy herd it is possible to introduce new genetic material solely by semen or embryos. Consideration should be given to minimising the number of sources of replacement cattle bovines.

3) The introduction of new genetic material should be introduced through the use of semen and embryos be considered whenever practicable.

4) If possible, cattle bovines should be sourced directly from herds of origin because live animal markets or other places where cattle bovines from multiple properties are mixed for resale may increase the risk likelihood of spread of Salmonella and other infections infectious agents among cattle bovines.

5) newly introduced cattle bovines should be kept separate from the rest of the herd for a suitable period before mixing with other cattle bovines - e.g. four weeks.

6) where appropriate, for example with cattle of unknown status, pooled faecal samples from introduced cattle could be taken to assess their Salmonella status.

7) where when appropriate, testing of animals for Salmonella prior to introduction or mixing with other cattle bovines should be considered to inform subsequent control measures, for example, when introducing cattle bovines of unknown status.

Article 6.X.8.

On farm cattle Management of bovines on farm

To minimise reduce the risk likelihood of transferring Salmonella among cattle bovines, it is recommended that:

1) cattle bovines with suspected salmonellosis or otherwise sick should be separated from healthy cattle bovines.

2) Care of healthy cattle bovines should be carried out prior to care of cattle bovines with suspected salmonellosis.

3) Priority should be given to the hygienic management of calving areas, for example keeping perinatal cattle bovines separated from sick cattle bovines and maintaining a clean environment.

4) cattle bovines should be segregated according to age.

5) When possible, the ‘all-in-all-out’ principle for production cohorts should be used. In particular, the unnecessary mixing of different age groups during rearing, especially of calves should be avoided.

6) Consideration should be given to the potential for between-herd transmission of Salmonella via breeding, rearing and grazing of cattle bovines from multiple sources on a single site, for example shared pasture, and heifer rearing, or sharing of bulls.

7) Consideration should be given to the potential for between-herd transmission of Salmonella through direct contact between cattle bovines across boundary lines or indirectly, for example through contamination of water courses.
Feed and water - Feed and feed ingredients

1. Compound feed Feed and feed ingredients

Compound feed Feed and feed ingredients can be sources of Salmonella infection for cattle bovines. For the effective control of Salmonella it is recommended that:

1a) Where appropriate, compound 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.

2b) Compound where practical, feed Feed and feed ingredients should be transported, and stored and fed in a hygienic manner that minimises contamination by manure faecal waste and, where practicable, minimises access by domestic animals, wild birds, rodents and other wildlife.

2. Water

Where there is reason to be concerned about infection of cattle with Salmonella from contaminated water, measures be taken to evaluate and minimise the risk. For example sediment in water troughs may act as a reservoir for contamination.

Article 6.X.10.

Water

Drinking water Water for drinking should be of an appropriate quality. When there is reason to be concerned about infection of cattle bovines with Salmonella from contaminated water, measures should be taken to evaluate and minimise the risk. For example sediment in water troughs may act as a reservoir for contamination. Where practicable, untreated surface water should be avoided as a water source.

Article 6.X.11.

Prevention, treatment and control Additional prevention and control measures

1) The immune status of calves is important and therefore care should be taken to ensure that newborn calves consume adequate amounts of high quality colostrum in accordance with Article 7.9.5 (point 3c)] and Article 7.X.5. Raw milk from infected cows should not be fed to calves.
1) **Antimicrobial agents** may modify normal flora in the gut and increase the likelihood of colonisation by *Salmonella*. If antimicrobial agents are used, they should be used in accordance with Chapter 6.9. **Antimicrobial agents** should not be used to control subclinical infection with *Salmonella* in cattle because the effectiveness of the treatment is limited, they may increase the risk of *Salmonella* colonisation, and their use can contribute to the development of antimicrobial resistance.

2) **Vaccination** may be used considered as part of a *Salmonella* control programme. Vaccine production and use should be in accordance with Chapter 1.1.6. of the Terrestrial Manual. The protective effect of vaccines is generally serotype-specific and few licensed vaccines are available for cattle, and is influenced by factors such as timing of vaccination in relation to exposure.

3) Use of probiotics may reduce colonisation of cattle by *Salmonella* and shedding of *Salmonella*; however, efficacy is variable.

4) Because conditions such as a number of conditions, for example liver fluke and infection with bovine viral diarrhoea virus, may increase the susceptibility of *cattle bovines* to *Salmonella*, therefore, control of these such conditions is recommended.

5) The immune status of calves is important and therefore care should be taken to ensure that newborn calves consume adequate amounts of high quality colostrum.

4) **Stress** may increase the susceptibility of *cattle bovines* to *Salmonella*. Management of potentially stressful situations, such as mixing of groups of *cattle bovines*, may reduce the likelihood of clinical disease or shedding of *Salmonella*.

5) **Antimicrobial agents** may modify normal flora in the gut and increase the likelihood of colonisation by *Salmonella*. In circumstances when antimicrobial agents are considered necessary for the treatment of clinical enteric salmonellosis, they should be used in accordance with Chapter 6.9. Furthermore, antimicrobial agents should not be used to control subclinical infection with *Salmonella* in *cattle bovines* because the effectiveness of the treatment is limited, they may increase the risk of *Salmonella* colonisation, and their use can contribute to the development of antimicrobial resistance.

### Article 6.X.112

**Transportation**

Hygienic maintenance of vehicles is recommended. Vehicles should be properly cleaned and disinfected after transportation of animals, in accordance with Chapter 4.13.

When transporting animals from multiple **establishments**, it is recommended that the *Salmonella* status of the **establishments** should be considered to avoid cross-contamination of *cattle bovines*.

In addition, the relevant recommendations in Chapters 7.2., 7.3. and 7.4. apply.

When transporting animals from multiple **establishments**, it is recommended that the *Salmonella* status of the **establishments** be considered to avoid cross-contamination of cattle.

### Article 6.X.1213

**Lairage**

Relevant aspects of **lairage** management include consideration of effective cleaning and disinfection between groups, minimising mixing of separate groups animals that have not continuously been kept together and managing stress.

In addition, the relevant recommendations in Articles 7.5.1., 7.5.3. and 7.5.4. apply.
Article 6.X.14.

Cleanliness of hides

Cleanliness of hides can be achieved by applying suitable practices during housing (for example additional clean bedding), transport and lairage. Dirty hides increase the risk of microbial contamination of carcasses during the slaughter process. Contamination can be reduced by hide washing of the live animal or of the slaughtered animal before hide removal.

Article 6.X.15.

Surveillance in cattle for Salmonella in commercial cattle bovine production systems

Surveillance data provide information to assist the Competent Authorities in their decision making regarding the requirement for, and design of, control programmes and in setting and verifying performance objectives. Sampling and testing methods, frequency and type of samples required should be determined by the Veterinary Services.

Standards for diagnostic tests are described in the Terrestrial Manual. In addition, other sampling and testing methodologies such as testing of bulk milk or serum samples by ELISA may provide useful information on herd or individual animal status. Boot swab samples from communal areas in cattle housing for bovines, slurry samples, or caecal or lymph nodes samples collected post-mortem can also be useful for microbiological testing. Some serotypes of Salmonella such as S. Dublin can be difficult to detect through using microbiological methods.

If vaccination is used, if serology is used as the surveillance method, it may not be possible to distinguish between vaccinated and infected cattle bovines by means of serological testing.

Article 6.X.16.

Prevention and control in low prevalence regions

In regions where Salmonella infection of cattle bovines is uncommon, it may be possible to maintain low prevalence status or eliminate infection from herds through a combination of good farming practices, herd surveillance, individual testing, movement controls, and possible or and removal of persistent carriers.

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