DISCONTOOLS

Salmonella enterica salmonellosis
Summary

Introduction

1. This note provides a brief summary of an analysis undertaken by a DISCONTOOLS group of experts on Salmonellosis. They reviewed the current knowledge on the disease, considered the existing disease control tools, identified current gaps in the availability and quality of the control tools and finally determined the research necessary to develop new or improved tools. Full details can be downloaded from the web site at http://www.discontools.eu/ by selecting Disease Database, then the specific disease and highlighting the variables of interest. This is completed by selecting "create a report" which can then be downloaded as either a PDF or Excel spread sheet

Disease profile

2. *Salmonella*e are found worldwide in both warm and cold blooded animals and also in the environment. There are thought to be at least 2500 serovars of *Salmonella*e although the two most commonly encountered in cases of food poisoning of humans are *S.* enteritidis and *S.* typhimurium. The disease is considered to be more prevalent among intensively reared animals, in countries with less strict control programmes and in hotter countries.
3. In animals, the usual sign of salmonellosis is diarrhoea although other clinical signs including septicaemia, abortion and pneumonia, can also occur. Acute cases in animals and poultry can lead to death and mortality rates may be high.
4. In humans the disease causes diarrhoea, abdominal pain, fever, headache, nausea and vomiting. In severe cases septicaemia and further complications may develop. Death can occur. The most serious cases are generally among infants, small children, the elderly and those with suppressed immunity. Infection is usually via ingestion of contaminated food but can also be by direct contact with animals or with faecally-contaminated environments.
5. Some animals that apparently recover from salmonellosis may become permanently infected and a small number may excrete the organism in their faeces for years. Others may harbour a latent infection and only excrete the bacterium during periods of stress. Most animal infection results from spread by carrier animals or contaminated feed and the faecal-oral route is the normal mode of transmission. In intensive poultry in particular, vertical transmission via the egg is a recognised route of transmission

Risk

6. There has been a reduction in the number of reported cases of salmonellosis in humans in the EU in recent years, largely as a result of improved control of *S.* Enteritidis in poultry. There has, however, been an increase in *S.* Typhimurium and its monophasic variant, thought to be largely associated with increased pig-meat related cases. Human infection is greatest in the summer and this is thought to be associated with difficulties in maintaining low temperatures of food and use of undercooked meat after outdoor cooking.
7. Spread between holdings can be rapid if carrier animals are distributed widely. *Salmonella* can survive for months in the environment. Rodents, wild birds and insects may act as vectors. A number of measures on-farm, including disinfection, removal of excrement, checking of feed and monitoring of bought-in animals will help to control *Salmonella* outbreaks. Surveillance and slaughter techniques with poultry have reduced the number of human infections from eggs or poultry meat considerably in EU countries but there is no means of eradicating the disease and a varying level of infection still persists.

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Diagnostics

8. A number of serological tests are available for the diagnosis of Salmonellosis. Whole blood tests and serum agglutination tests have been used for a long time and ELISAs are now in routine use. Dependant on the antigen and tests used serological cross-reactions between different serovars and even with some non-*Salmonella* organisms can occur so bacterial isolation must be used for confirmatory diagnosis. There are PCR and micro-array based

antigen tests but they have not been validated for statutory use. A molecular serotyping test targeting the main *Salmonella* serovars has been developed and OIE validated. Other molecular typing methods require validation.

9. Several commercial immunodiagnostic kits for *S.* Enteriditis and *S.* Typhimurium are available. These kits should be validated prior to use for surveillance purposes and are not suitable for vaccinated animals.
10. Tests that can more rapidly detect and characterize *Salmonella* are needed, including rapid and simple tests that could be used on-farm.

Vaccines

11. There are many inactivated vaccines that are used against salmonellosis. Live vaccines have been used in some countries although EU legislation dictates that they are not used unless an appropriate method is provided to distinguish wild type strains of *Salmonella* from vaccine strains. Mutant vaccines attenuated rationally by molecular biological gene deletion techniques have also been developed and genetically modified vaccines are available in certain countries. There are no marker vaccines yet available.
12. The current vaccines are claimed to reduce the infection and mortality in poultry and other species and are not guaranteed to prevent infection.

Pharmaceuticals

13. The use of antibiotics for the treatment of salmonellosis in many countries is very limited because of the risk of further developing the incidence of drug resistance. Antibiotic treatment is normally restricted to cases where the disease is serious and life threatening.
14. Any new antibiotics will probably be restricted to use in human medicine for the foreseeable future. The potential for developing new antibiotics for agricultural use is thought to be limited. Antibiotic treatment of flocks of poultry is generally not permitted for control of *Salmonella* unless there is a welfare implication or rare genetic stock would be lost if culled.
15. Prevention of infection may be aided by the use of prebiotics, probiotics and competitive exclusion agents.

Knowledge

16. More needs to be known of serovar variability in different countries and the variability within a serovar. There is a lack of knowledge concerning virulence factors and also host/pathogen interactions in the main target species.
17. Detailed longitudinal and quantitative data on herd infection and environmental contamination dynamics are needed in order to better understand the epidemiology and to populate transmission models. More needs to be known of the relative risk of different vectors, different sources of infection and infectious doses. Details of bacterial shedding, including variability, time and numbers, in food animals and in humans are lacking. The reasons for global spread of some strains but not others and for the rise and fall of epidemic strains are poorly understood.
18. Validated procedures for minimising *Salmonella* populations on large farms, especially pig farms, are lacking. Cost benefit analyses of control measures are lacking and are needed to provide convincing evidence of the value of investment in *Salmonella* prophylaxis

Conclusions

19. *Salmonella*e are widespread in the environment and salmonellosis is most prevalent in areas of intensive animal husbandry. Many animals may be infected but show no clinical illness and are therefore important in the spread of the disease. The widespread nature of the bacteria together with its longevity and diversity in the environment will be the main obstacles to prevention and control.
20. There is a need for improved diagnostic methods and techniques for strain identification and typing. Vaccines are available but better and more effective products are required and more needs to be known about the best use of vaccines in control programmes.