Salmonella control: protecting eggs and people

A European Food Safety Agency (EFSA) study recently showed that the percentage of layer flocks infected with Salmonella is still very high in some countries. Many EU member states therefore have to increase their efforts to reduce these levels. Vaccination is an important tool in a Salmonella control programme.

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"Protecting eggs, protecting people"

The recent EFSA study on the prevalence of salmonella in laying hens showed that, despite many efforts to reduce the incidence, many European countries still have a high percentage of *Salmonella enteritidis* (Se) and *Salmonella typhimurium* (St) positive layer flocks.

The cornerstones to reduce the number of salmonella positive flocks are strict hygiene, decontaminated feed and improved poultry management. Re-infection with Salmonella could also take place via other sources such as rodents, wild birds and visitors.

Another important tool to reduce the incidence of salmonella in poultry is vaccination. The salmonella vaccines currently on the market can be categorised as either live or inactivated. Their use will be determined by their individual features, benefits, and end market requirements.

Live salmonella vaccines, as the name suggests, contain live attenuated strains of salmonella serotypes. Individual products are available that protect against either Se or St, so the first question is against which serotype protection is required.

Some European countries require compulsory vaccination against Se and St.

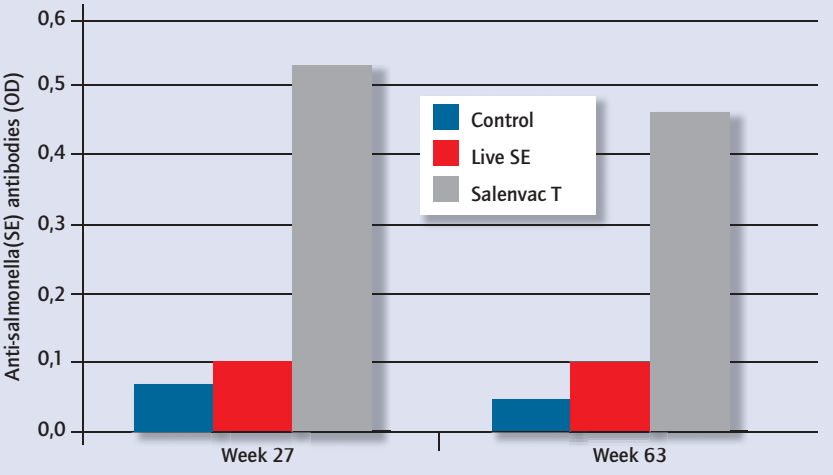
Live or inactivated vaccination?

One significant factor that favours the use of live vaccines is their administration route. Typically, live vaccines are given orally in drinking water making them convenient for the producer to use, particularly for caged layers. Live vaccines generate their immunity within the gut. This tends to reduce the shedding of salmonella in the flock's environment. This is extremely valid when wanting to reduce the threat to the food chain. However, such immunity is only likely to be local and thus no passive immunity is transferred to the progeny. So this progeny still can be the vector for Salmonella contamination in the food chain.

For producers looking to increase the level of protection beyond just the bird itself, particularly relevant to broiler breeders wanting to transfer passive immunity to broiler chicks and layers in high challenge or high risk (for example, free-range) environments, the use of an inactivated vaccine (such as Salenvac T) could provide the required solution.

Salenvac T is administered via injection, rather than into the gut as with live drinking water vaccines, so it generates humoral antibodies which are concentrated in the eggs. Recently completed

Figure 1 - Anti-Se antibodies in egg contents



EU Commission sets targets to reduce salmonella in poultry

The European Commission has set new targets for member states to reduce the presence of salmonella in poultry. It has proposed trade bans on eggs from flocks with persistent high levels of the pathogen.

On 1 August the European Commission adopted two regulations to reduce and control the prevalence of salmonella in laying hens and eggs across the EU. The Commission has also considered the possibility of introducing a trade ban on eggs from salmonella infected flocks as soon as possible. This may help packing stations and processors to remove the pathogen from their supply chain and to restrict their sources of eggs and poultry.

The rules follow the publication in June of a European Food Safety Agency (EFSA) study, which found that about one in five of the EU's large scale commercial egg producers have laying hens infected with the salmonella pathogen.

In view of the EU regulations, many countries will have to increase their efforts to reduce the percentage of Salmonella enteriditis (Se) and Salmonella typhimurium (St) positive flocks. This regulation implies an annual minimum reduction of the percentage positive flocks of adult laying hens of at least:

- 10% if the prevalence of the previous year was less than 10%
- 20% if the prevalence of the previous year was less than 20%
- 30% if the prevalence of the previous year was between 20 and 39%
- 40% if the prevalence of the previous year was 40% or more

For example: when a country has a percentage of Se and St positive flocks of 60% in 2008 they have to decrease this to 36% (a decrease of 40% of the 60% of the previous year).

The first target should be achieved in 2008, and will be based on the monitoring starting in early 2008. The result of the baseline study *(Figure 2)* will be used as a reference. The ultimate target is to achieve a reduction in salmonella levels to two per cent or less.

Differences by country

The study found out of a total of 400, 000 human cases of zoonoses reported during 2004, there were 192,703 cases of salmonellosis and 183,961 of campylobacteriosis in the EU's 25 member states. This shows that salmonellosis and campylobacteriosis, are by far the most frequently reported foodborne diseases in the EU. Both diseases are frequently caught through ingesting poultry and poultry products, such as eggs.

At EU-level the presence of salmonella was detected in about 31 percent of the large-scale laying hen holdings surveyed. The testing did not find salmonella species in any large scale commercial egg producers in Luxembourg and Sweden. The highest levels were found in Czech Republic, Poland, Spain and Portugal. Se and St specifically were found in an average of 20 percent of the large-scale laying hen holdings tested across the EU, with no cases found in Sweden, Ireland, Cyprus, Luxembourg, Latvia. Holdings in the UK, Netherlands, France and Italy were generally at the low end of the scale.

Sampling and testing

The new EU regulation sets out requirements for sampling and testing for salmonella in laying hens, as well as the procedures for reporting results. Country regulators have six months to submit national control programmes to the Commission for approval and for EU funding.

The Commission has also presented a proposal to member states to speed up the proposed implementation of EU-wide trade restrictions against those with persistent high levels of the pathogen in domestic egg-producing flocks.

The EU's current Zoonoses Regulation sets out plans that would completely ban the retail sale of eggs from salmonella-infected flocks from 2010. Eggs will have to undergo a sterilisation procedure if they are to be used for processing into egg products.

The second regulation, setting out rules on the methods used to control salmonella in poultry, includes a requirement for mandatory vaccination from 1 January 2008 onwards for laying hens in states with a salmonella prevalence of 10 percent or more. The vaccinations used must be authorised at EU level, and must be distinguishable from the field bacteria during sampling and testing.

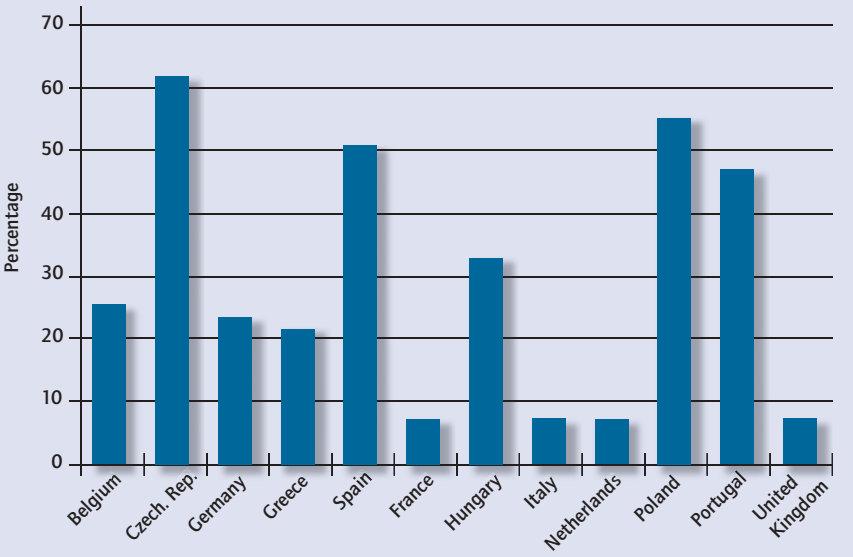
National authorities may exempt a holding from this vaccination requirement provided satisfactory preventive measures are being applied or there has been no incidence of salmonella on the holding over the previous 12 months.

EFSA has recommended that antimicrobials should not be used for salmonella control in livestock, due to the public health risks associated with development, selection and spread of antimicrobial resistance.

In addition, if poultry is treated with antibiotics, the detection of salmonella is difficult, which could lead to a hidden infection in the flock. The regulation bans the use of antimicrobials as part of national control programmes for the control of salmonella, except under very limited circumstances.

Similar targets on pathogens have already been set at EU level for breeding hens. The European Commission plans to bring forward separate targets to reduce salmonella in broiler hens, turkeys and certain types of pigs in the coming years.

Figure 2 - Prevalence of Se and St in EU member states



Source: Analysis of the baseline study on the prevalence of salmonella in laying hen flocks, carried out October 2004- September 2005, EFSA preliminary report, published, 14 June 2006.

research shows that these antibodies are present in eggs (studies presented at the 4th International Symposium Salmonella and Salmonellosis, May 2006 St Malo France). Also, chicks hatched from eggs from vaccinated birds have these maternally-derived antibodies (MDA) which are able to provide them with a level of immunity during their first critical weeks of life.

Antibody levels

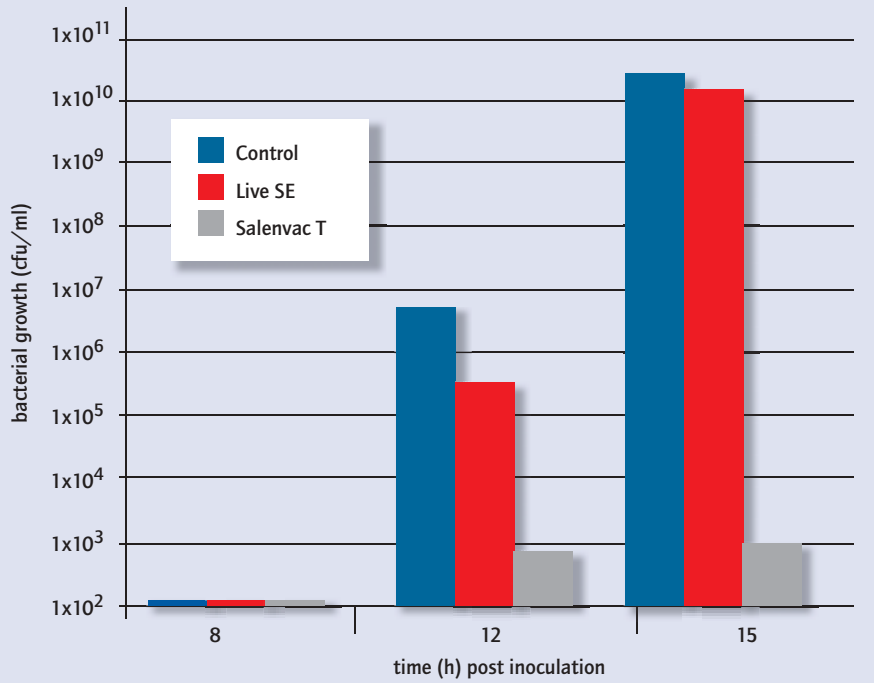
This trial compared eggs from non-vaccinated birds with those from birds vaccinated with either a commercially available live Se vaccine or an inactivated vaccine (Salenvac T). The inactivated vaccine provides immunity against both Se and St.

Initially, the eggs were analysed to determine the presence of anti-salmonella antibodies. The results are shown in *Figure 1*. It is noticeable how high the inactivated vaccine antibodies remain at 63 wks.

Antibody levels in eggs from Salenvac T-treated birds were abundant and there was little effect throughout the production period. Literature data suggest that the growth of Se in egg contents may be dependent on the vaccination status of the chickens. A study was conductedto determine the effect of vaccination on the ability of Se to grow in homogenised eggs.

Eggs were obtained from age-matched commercial flocks (24-25 weeks old) where the hens had been vaccinated with either an inactivated or a live Se vaccine according to manufacturer's recommendation. Eggs from Specific Pathogen Free hens were used as

Figure 3 - Bacterial growth in egg contents inoculated with Se



controls. The ability of the homogenised egg contents to support bacterial growth was monitored using a virulent Se strain.

Eggs from each batch were pooled, homogenised (yolk and albumen) and were then inoculated with low numbers of Se cells (generally 10-100 cells per culture) and incubated at 37°C. The number of viable salmonella was determined at intervals by plating serial dilutions of the egg cultures to determine the numbers of viable bacteria.

Se grew readily in the homogenised egg contents of eggs from SPF and from live Se vaccinated hens. Statistical analysis of the data revealed a statistically significant reduction in bacterial multiplication in eggs from Salenvac T-vaccinated hens when compared to bacterial growth in eggs from either the live Se vaccinated group or the SPF group. No statistically significant differences in bacterial multiplication were observed between eggs from live Se vaccinated hens or unvaccinated SPF hens *(see Figure 3)*.

This demonstrates that eggs from birds vaccinated with an inactivated vaccine grow significantly less bacteria compared to eggs from unvaccinated controls or those vaccinated with a live SE vaccine. ■