SALMOSAN® SHOWS ITS EFFICACY ON THE CONTROL OF SALMONELLA IN PIGS

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These results were presented at the 9th and 10th International Conferences on the Epidemiology and Control of Foodborne Pathogens and Antimicrobial Resistance in Pigs and Pork (SAFEPORK), Maastricht (The Netherlands) June 2011 and Portland (Maine, USA) September 2013, respectively. It has also been published on the magazine AVANCES in April 2014.

Despite the significant decrease throughout Europe in the number of human cases of salmonellosis linked to poultry and their products, salmonellosis remains the most important zoonosis regarding the number of reported outbreaks. The success of the Salmonella control programs in poultry has resulted in a relative increase in the number of pig-related outbreaks in humans, emphasizing the need for establishing control programs for this animal species.

Within the international pig/pork trade business, most main pig producing countries have been implementing Salmonella control programs for years. However, Spain, the second major European country with regard to pig production, has not yet started any program of control at the herd level despite of the high Salmonella prevalence detected in slaughter pigs (29%; EFSA, 2007). In the short term, countries like Spain should initiate actions to prevent putting their exports at risk.

Keys to fight against pig salmonellosis

The fattening period is considered a critical step for Salmonella infection. Pigs are mostly infected after the ingestion of feces from infected animals, but also through consumption of water, as well as through vectors, fomites, contaminated feed etc. Infected animals often become asymptomatic carriers and intermittent shedders of the bacteria in the feces, being considered the main responsible for the contamination and spread of Salmonella in the environment. Under stress situations, such as those occurring during transport or lairage, shedding will be especially favored and these animals will undoubtedly be an important source of contamination of carcasses and meat at the slaughterhouse.

The use of certain naturally-derived food additives, such as those fungus- and/or plant-derived non-digestible oligosaccharides has proven as an effective complement to basic control activities, such as strict hygiene, and proper biosecurity and animal management. Indeed, combinations of mannan-oligosaccharides, such as Salmosan®, a β-galactomannans enriched product of vegetable origin, would increase the resistance of pigs to Salmonella infection.
One of the main mechanisms of action of Salmosan® is the blocking of *Salmonella* type-I fimbriae. Such fimbriae are required for the attachment to the epithelial cells and the subsequent invasion of the intestinal wall. Thus, this blockade results in the elimination of inactive bacteria through the feces. This important barrier effect against *Salmonella* spp., which also occurs against other pathogens such as *E. coli*, is amplified by the way in which the product is technologically purified.

Besides its capacity to agglutinate pathogenic bacteria, Salmosan® also shows prebiotic and immunostimulant effect. Thus, it stimulates growth of beneficial intestinal bacteria while improves local and systemic immunity.

Last year, the first results of a series of field trials, carried out with the participation of the Agrifood Research and Technology Center (CITA) of the Government of Aragon, to determine the efficacy of the addition of Salmosan® in the diet of fattening pigs for the control of salmonellosis were presented. Next, we present a new set of field trials which support the efficacy of Salmosan® in protecting fattening pigs against *Salmonella* infection.

**Efficacy of Salmosan® in commercial pig fattening units**

Two field trials were carried out in one small commercial pig fattening unit. In the first trial (Trial 1), a dose of 3 kg of Salmosan®/Ton of feed was administered during the fattening period on half of the pigs (50) from this unit. The other 50 pigs received the same feed without Salmosan®. In a second test (Trial 2), the dose used was 2 kg of Salmosan®/Ton of feed during the fattening period. In this occasion, each group was composed of about 100 pigs.

Individual fecal samples from a representative number of animals (>50%) in each group were collected at 60 and 90 days after entering in the fattening unit, and again at the slaughterhouse, in order to assess the proportion of pigs shedding *Salmonella* over the entire fattening period. After slaughter, samples of mesenteric lymph nodes (MLN) were also collected to estimate the prevalence of infection in each group.

Serum from all the animals was also collected at several time points (60 and 90 days after entering in the fattening unit and just before slaughter) to assess the previous pig exposure to *Salmonella* spp. by means of the detection of specific antibodies. Isolation of *Salmonella* spp. in feces and NLM was performed following the standard protocol ISO 6579:2002. Serological analyses were performed using a commercial ELISA (Herdcheck® *Salmonella*, IDEXX Laboratories).
Results and discussion

Microbiology

Figure 1 shows the microbiological results for the two field trials performed at different doses (2 and 3 kg of Salmosan®/Ton of feed) at different sampling times.

Figure 1. Mean percentage of *Salmonella*-positive pigs during the fattening period and at slaughter after the addition of two different doses of Salmosan® in the diet.

An increase in the number of pigs shedding *Salmonella* (isolation of *Salmonella* spp. from feces) was observed in the control groups along both trials. These differences were not significant at the first sampling in Trial 1 (3 kg of Salmosan®/Ton of feed), probably due to the low transmission of *Salmonella* spp. at this phase of the fattening period, which prevented to observe large differences between groups.

By contrast, at the start of Trial 2 (2 kg of Salmosan®/Ton of feed), exposure to *Salmonella* spp. appeared to have been important, given the high prevalence observed in the control group after 60 days of fattening. The group fed with Salmosan® showed a proportion of pigs shedding *Salmonella* significantly lower than that in the control group from the beginning of the trial.

The high levels of shedding and of infection prevalence (isolation of *Salmonella* from lymph nodes) observed at slaughter in the control pigs in Trial 1, suggest that the circulation of *Salmonella* spp. among these animals was particularly marked either during the last month of fattening or during the transport or lairage.

Despite this increased circulation of the pathogen, treated animals showed shedding levels very low or null.

As suggested by the results in the control group in Trial 2, the infection was already established at the beginning of the fattening period, as more than 25% of the pigs were shedding *Salmonella* in the first sampling. This percentage increased notably at
the time pigs reached the slaughter (59.4%). The prevalence of infection at slaughter approached these levels of prevalence (43.5%). By contrast, the results clearly show that the addition of 2 kg Salmosan®/Ton of feed reduced the proportion of shedders and of infected animals in the treated group to percentages ≤12%.

**Serology**

Overall, a lower seroprevalence (cutoff OD%≥40) was observed during the fattening period in the Salmosan® treated groups in both trials, but these differences were not large enough to be statistically significant (Figure 2). However, at the end of the two trials important differences in seroprevalence were observed. These differences were larger in Trial 1, when the highest dose of Salmosan® (3 kg/Ton of feed) was used.

**Figure 2.** Mean percentage of seropositive pigs to *Salmonella* spp. (DO≥40%) during the fattening period and just before slaughter after the addition of two doses of Salmosan® in the diet.

![Graph showing seroprevalence](image)

**CONCLUSIONS**

The addition of 2 kg Salmosan®/Ton of feed allowed a reduction greater than 75% in the proportion of pigs shedding *Salmonella* and of the *Salmonella*-infected pigs just before slaughter. Regarding serology, the reduction in the percentage of *Salmonella* seropositive pigs ranged between 60 and 80%. In addition, results from these two trials highlight the marked dose-response effect exerted by Salmosan®. Thus, using the highest dose (3 kg/Ton) a greater reduction in shedding and seropositive pigs is observed.

**According to these results, it can be concluded that Salmosan® has a protective effect against *Salmonella* infection in animals treated with doses of ≥2 kg/Ton of feed during the fattening period.**