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Efficacy evaluation of Enterisol® SC-54 in swine following challenge with a virulent *S. typhimurium* strain

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Introduction

According to a Center of Disease Control and Prevention estimate, 1.4 million individuals in the US suffer from Salmonella-associated disease every year[1]. The most important serovar in this context is *S. typhimurium*, which accounts for 21.9% of all Salmonella isolates. *S. typhimurium* is also the most frequently isolated serovar from clinical pig samples[2]. As pork products are frequently associated with clinical Salmonellosis in humans[3], *S. typhimurium* control in pigs is an important food safety issue. Whereas *S. typhimurium* can cause enterocolitis in pigs, the majority of infections prevail subclinically resulting in substantial economic losses due to a reduction in daily weight gain[4]. The purpose of this study was to determine if Enterisol SC-54, which is based on an attenuated *S. cholerasuis* strain, can be used to control *S. typhimurium* in pigs.

Materials and Methods

The study consisted of 3 groups. Group 1 (21 animals) was vaccinated at day 0 with 2 mL Enterisol SC-54. At day 28, group 1 and group 2 (21 animals; challenge control) were challenged with 2 mL virulent *S. typhimurium* (BIVI 02-04) culture. Group 3 (20 animals) served as strict control. Criteria to determine protection included display of clinical symptoms, weight gain, fecal shedding of Salmonella, and the results of the pathological examination (presence of gross-lesions, colonization of inner organs by Salmonella), which was conducted two weeks after challenge. Shedding of the vaccine strain and seroconversion (IDEXX Salmonella Herd Check™) were monitored. The data was analyzed using a SAS environment. Applied tests included ANOVA and Chi-Square/Fisher's Exact analysis.

Results and Discussion

Compared to the non-vaccinated challenge control group, the Enterisol SC-54 group showed significantly ($p \leq 0.05$) fewer clinical symptoms relevant to their general well-being. There was also a significant ($p \leq 0.05$) reduction in the prevalence of respiratory symptoms, loose feces/diarrhea, and decreased hydration. A significant ($p \leq 0.05$) reduction in the prevalence of enteropathy/enteritis affecting the small intestine, as well as a significant ($P \leq 0.05$) reduction of the Salmonella recovery rate from the mesenteric lymph node compared to the non-vaccinated pigs was also observed in the Enterisol SC-54 vaccinated animals. A summary of these results is given in table 1.

Table 1: Statistical significant differences between groups regarding clinical, pathological, and bacteriological findings.

	Enterisol® SC-54	**Challenge Control**	**Strict Control**
	positive findings in %		
impaired GWB[1)]	2.25*	7.64	0 .00
respiratory symptoms	0.00*	5.05	0.00
decreased hydration	0.78*	4.80	0.00
loose feces/diarrhea	9.71*	19.43	0.00
enteropathy/enteritis[2)]	10.00*	73.33	35.29
Salmonella recovery MLN[3)]	36.84*	73.33	0.00

*Differences between Enterisol SC-54 and Challenge Control groups are statistical significant ($p \leq 0.05$; Chi-Square/Fischer's Exact analysis); [1)]GWB=General well-being; [2)]affecting the small intestine; [3)]MLN=mesenteric lymph node

In addition, the vaccinated animals showed a significant ($p \leq 0.05$) increase in average daily weight gain post-challenge (days 27-42) and a significantly ($p \leq 0.05$) higher weight at the end of the trial (day 42) compared to the challenge control group. The results are listed in table 2.

Table 2: Statistical significant differences between groups regarding weight and weight gain.

	Enterisol® SC-54	**Challenge Control**	**Strict Control**
Day 42 weight	62.10 lbs.* [1)]	57.67 lbs.	68.56 lbs.
ADWG 27 to 42[2)]	1.07 lbs.*	0.85 lbs.	1.36 lbs.

*Differences between Enterisol SC-54 and Challenge Control groups are statistical significant ($p \leq 0.05$; Chi-Square/Fischer's Exact analysis); [1)]all values are group means [2)]ADWG - Average daily weight gain between challenge and necropsy dates (trial day 27- 42)

Fecal shedding post-challenge, however, could not be prevented by vaccination. One of the vaccinated animals died of Salmonellosis after challenge, compared to four animals in the challenge control group. The animals did not sero-convert following immunization. Statistical significant shedding of the vaccine strain was not observed in the Enterisol SC-54 animals compared to the non-vaccinated controls. The results of this study demonstrated that vaccination with Enterisol SC-54 resulted in significant levels of protection following challenge with a virulent *S. typhimurium* strain. This indicates that Enterisol SC-54 can be a valuable asset in the control of *S. typhimurium* due to the reduction of economic losses from *S. typhimurium*-associated clinical and subclinical symptoms. Vaccination with Enterisol SC-54 does at the same time not impair serological evaluation of individual animals or whole herds due to the lack of detectable seroconversion following immunization. Enterisol SC-54 also seems to be an appropriate tool for food-safety management due to the effect on *S. typhimurium* colonization in the carcass as demonstrated by the reduction of mesenteric lymph node colonization.

References

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