

Incidence of Salmonellosis and identification of serogroups and serotypes in a pig commercial farm in Yucatan

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ABSTRACT. A study was conducted in order to detect the presence of *Salmonella* spp in fattening pigs, to identify the serogroups present and to determine the sensibility to the antibiotics more used in the region. The farm was a breeding farm of a multiple-site system. Of the total farrowings of a week, 55 sows and one piglet from each sow were selected. All pigs were negative to *Salmonella* spp. at the start of the study. Piglets were monitored from day two of age (six times; every 23 days approximately) up to finishing (23 weeks of age). Samples of feces (1 g/animal) were collected directly from the pig's rectum. The first positive pig was found at the second sampling (25 days) and the highest number of positive cases in the fifth sampling (117 days). The cumulative incidence was 52.7%. Thirty-four out of the 40 *Salmonellas* isolated corresponded to the B serogroup and 6 to the C2 serogroup. The serotypes found in the B serogroup were: *S. typhimurium* (28/34) and *S. agona* (6/34). Regarding serogroup C2 these were: *S. romanby* and *S. ajiobo*. *Salmonella* spp B serogroup included three of the serotypes more commonly isolated in humans: *S. typhimurium*, *S. agona* and *S. heidelberg*.

Key words: Pigs, *Salmonella*, serogroup, serotype, antibiogram.

INTRODUCTION

The pig industry is affected by a number of diseases caused by bacteria, virus, parasites and rickettsias. Part of the mortality and morbidity in the farms are due to enteric diseases. Among the organisms that cause those diseases are the bacteria of the genus *Salmonella*, which have been isolated in almost all vertebrates. In pigs these bacteria cause among other clinical signs enterocolitis and septicemia, which produce big economic losses.

Salmonella spp also affect the human being, therefore it is important from the point of view of the public health.

RESUMEN. Se realizó un estudio para detectar la presencia de *Salmonella* spp. en cerdos de engorda; identificar los serogrupos presentes y determinar la sensibilidad a los antibióticos más utilizados en granjas de la región. Se utilizó una granja de cerdos reproductores donde se practicaba el sistema de producción de sitios múltiples. Del total de partos de una semana de producción en un sitio I se seleccionaron al azar 55 marranas y de cada una un lechón negativo a la presencia de *Salmonella* spp. Los animales fueron monitoreados desde los dos días de edad en seis ocasiones (cada 23 días aproximadamente) hasta el finalizado (23 semanas). Las muestras de heces (1 g/animal) se tomaron directamente del recto de los cerdos. Para la determinación de los serogrupos se utilizaron antisueros específicos. A los serotipos identificados se les realizó un antibiograma probándose los antibióticos más usados en las granjas porcinas de la región. Los primeros cerdos positivos se encontraron en el segundo muestreo (25 días) y el mayor número de positivos en el quinto (117 días). La incidencia acumulada durante el período de estudio fue 52.7%. De los 40 aislamientos 34 correspondieron al serogrupo B y 6 al serogrupo C2. Los serotipos encontrados para el serogrupo B fueron *S. typhimurium* (28/34) y *S. agona* (6/34). Con respecto al serogrupo C2 se encontraron dos serotipos en cada aislamiento, *S. romanby* y *S. ajiobo*. La *Salmonella* estuvo presente en los cerdos de la granja estudiada. El serogrupo B encontrado comprendió tres de los serotipos más aislados en humanos: *S. typhimurium*, *S. agona* y *S. heidelberg*.

Palabras clave: Cerdos, *Salmonella*, serogrupo, serotipo, antibiograma.

Salmonella spp has been detected in meat and other animal products. In the abattoir, the equipment used by the workers and the lack of hygiene can contaminate the carcasses. Other studies, have reported contamination of packed products and meat, which is sold directly to the public.⁸

Contamination occurs because pigs are asymptomatic carriers of different serogroups of *Salmonella* spp and only one serotype causes on them the disease. When infected pigs arrive to the abattoir, they are stressed and could probably shed the bacteria contaminating the meat, by products and the equipment used by the workers in the abattoir.

In order to design programs for the prevention and control of *Salmonella* spp it is necessary to know the prevalence and disease distribution, serogroups and serotypes present in a given area and their susceptibility to the anti-

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biotics. Therefore, the objectives of this study were: 1) to detect the presence of *Salmonella* spp in fattening pigs; 2) to identify the serogroups and the most frequent serotypes; 3) to determine the pattern of resistance to the most common antibiotics used in the region.

MATERIAL AND METHODS

A commercial multiple-site pig farm with approximately 10,000 breeders was used. The farm was located at the central region of the state of Yucatan, Mexico. The region has a subhumid tropical climate with rains in summer. The average temperature is 26°C with a range of 7 to 42°C, the annual rainfall is 997 mm with a range of 700 to 1,400 mm and the relative humidity range between 61 and 87%.¹⁰

The management of the pigs was the commonly used in the multiple-site farms in the region, which consists basically of an all in all out system, fed a commercial diet.

Fifty-five sows were selected from the total farrowings occurred during one week of production and one piglet was selected from each litter. The sample size to detect the presence of *Salmonella* spp was calculated considering 5% prevalence and 95% confidence level.¹¹ All the piglets included at the beginning of the study were seronegative to the presence of *Salmonella* spp. Pigs were identified individually in order to determine the moment of *Salmonella* spp shedding. Pigs were monitored six times (each 23 days approximately) from the second day of age until 23 weeks of age.

Feces (1 g/animal) were collected directly for the animal rectum using sterile swaps and kept in tubes with an enriched medium (tetrionate and hajna). The samples were kept under environmental temperature and send to the laboratory of the Facultad de Medicina Veterinaria y Zootecnia of the Universidad Autónoma de Yucatán (FMVZ-UADY) where the bacteria were isolated using the technique described by Rappaport-Vasiliadis.⁷

To determine the serogroups, specific antibodies (DIFCO) were used. The serotyping was carried out at the National Institute for Diagnosis and Epidemiological of Mexico. An antibiogram with the most commonly antibiotics used in the pig farms of the region was carried out to identified serotypes. The antibiogram was conducted at the FMVZ-UADY using the agar diffusion test.

The frequencies and cumulative incidence of *Salmonella* spp was calculated.

RESULTS

The first positive pigs were found in the second sampling (25 days of age) and the higher number of positives in the fifth sampling (117 days, Fig. 1). Except by one animal, all pigs were positive only once during the study. The cu-

mulative incidence during the period of study was 52.7%.

Thirty-four out of the 40 isolations corresponded to the B serogroup and 6 to the C2 serogroup. The serotypes found in the B serogroup were: *S. typhimurium* (28/34) y *S. agona* (6/34). While in the C2 serogroup the serotypes found were: *S. romanby* y *S. ajio*. The serogroup studied were resistant to Lyncomycin/Spectomicin, Kitasamycin and Amoxicillin (Table 1).

DISCUSSION

The farm studied was positive, indicating that the prevalence of *Salmonella* spp is 5% or greater. Other authors⁵ working in 7 multiple-site farms also isolated *Salmonella*. Even though the multiple-site system is recommended as an alternative to control this and other diseases, this is not true in practice if health measures are not taken. Dahl et al.⁴ achieved *Salmonella typhimurium* pigs free, in multiple-site farms, only under strict control of feed, water, equipment, personal movement and management, that are difficult to implement under commercial conditions.

The cumulative incidence of *Salmonella* spp obtained in this study (52.7%) is greater than that mentioned by Davies et al.⁵ who reported 18 to 22% of the pigs positive to *Salmonella* in grow farms and by Fedorka-Cray et al.⁶ who obtained 38.2% in their study.

There are some factors that affect the results found in each farm. One of them is the climate that can favor or avoid the development of bacteria; other is the herd size, because the greater the number of pigs in the herd the greater the number of positives isolates to *Salmonella* spp, due to agglomeration of animals, which causes a higher stress and fighting for social rank.³

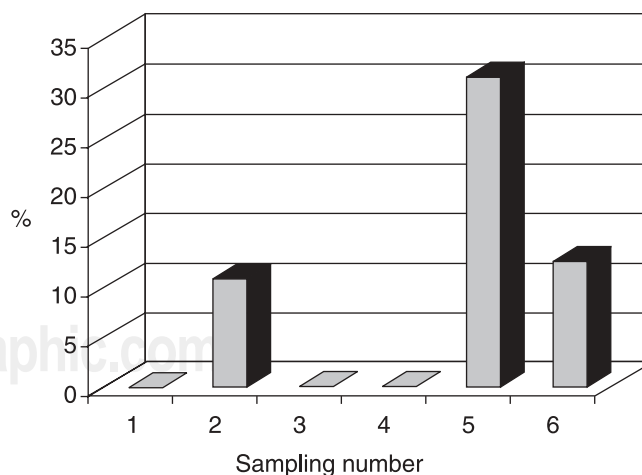


Figure 1. Percentage of animals positive to *Salmonella* spp.

Table 1. Antibigram for different serotypes of *Salmonella* spp.

Antibiotic	Concentration (µg)	Resistant (mm)	Sensible (mm)	Serogroup B		
				<i>S. typhimurium</i>	<i>S. agona</i>	Serogroup C2
Lyncomycin/Spectinomycin	50+50	≤10	≥11	22(R)	5(R)	6(S)
Magnacin	10	<7	>11	22(TS)	5(TS)	6(TS)
Sulfaclopiridazine + Trimethoprim	23.75+1.25	<7	>11	22(TS)	5(TS)	6(TS)
Neomicyn	30	≤12	≥17	16(S) 6(I)	3(S) 1(I)	4(S) 2(I)
Furaltadone	300	<7	>11	21(TS) 1(S)	5(TS)	6(TS)
Kitasamicin		<9	>16	22(R)	5(R)	6(R)
Ceftiofur sodic	30	<19	>24	22(S)	5(S)	6(S)
Gentamicin + Nalidixic acid	10+30	<7	>11	22(TS)	5(TS)	6(TS)
Amoxicillin	20	<7	>11	22(R)	5(R)	6(R)
Ciprofloxacin	5	<15	>24	21(S) 1(I)	5(S)	6(S)
Sulfadoropiridazin/Sulfametazin/Trimethoprim	12.5+12.5+5	<13	>17	22(S)	5(S)	6(S)
Flumequine	30	<12	≥16	22(S)	5(S)	6(S)
Eritrocin/Olaquinox	30+6	≤14	≥18	22(S)	5(S)	6(S)

R = Resistant; I = intermediate; S = sensible; TS = Too sensible

The B serogroup is one of the most frequent in pigs. Van der Wolf¹⁹ found this serogroup in 88.6% of the isolates, whereas in other studies it represented 65%. In our study the B serogroup was the most frequent followed by C2 serogroup.⁶ Three of the serotypes more frequently isolated in humans (*S. typhimurium*, *S. agona*, *S. heidelberg*)^{6,16} were found in the B serogroup. This is an important finding because the pigs could be a source of human contamination. Some authors^{12,13} mention that all salmonellas are potential pathogens for the human being and that these contaminate most of the sources of protein for human consumption.

The workers of the farm can be carriers of the bacteria for long periods of time, being sources of contamination for the pigs.¹⁴ The weaker pigs are also sources of contamination for the other pigs, because they remain for longer periods of time in the farm and get in contact with other animals, infecting them.³ It is important to mention that the salmonellas can be found frequently in rodents^{2,15} which difficult the control. These reservoirs exist in the farm and in the abattoir.

With respect to the use of antibiotics there is still some controversy about to their accuracy for the control of salmonellosis. For the control of the disease in animal populations, antimicrobials are used both therapeutically and non-therapeutically. Therapeutic use is thought to play a minor role in the development of resistance. Conversely, the use of antimicrobials in large number of animals in low concentrations over long periods of time increase significantly the resistance, particularly when the antibiotics are overprescribed or improperly used.⁷ Taylor¹⁷ indicates that the antibiotics decrease the shedding of *Salmonella* spp. However, some serotypes of salmonella and other bac-

terias have plasmids that provide resistance to a variety of antibiotics (p.e trimethoprim and ciprofloxacin). This resistance could be originated by the plasmids of the *Salmonella* itself or by interaction with other bacteria that have resistant plasmids.¹⁸ Knowing about bacterial resistance allows us to choose the best treatment and a better use of antibiotics in the control of the disease, which increases the importance of identifying the serotypes involved.⁷ The pattern of resistance of *Salmonella* agrees with long periods of the use of large amounts of antibiotics. *Salmonella* show resistance to G penicillin and chlortetracycline.⁹ However, the use of antibiotics do not decrease the shedding of *Salmonella* spp by the infected pig;¹ which agrees with the results here obtained; however, in this study bacitracin and enrofloxacin were used. In veterinary and human medicine antibiotics with similar formulation are used (p.e., sulpha + trimethoprim, amoxicillin, neomicine etc), therefore it is recommended its correct use considering time and concentration to avoid the risk of resistance by Salmonellas; also it is recommended the use of other formulations exclusive for veterinarian use (p.e., tilmicosin, magnasim or ceftiofur).

The high cumulative incidence (52.7%) of *Salmonella* spp indicates that more than half of the pigs shed in certain moment the bacteria, and although the pigs do not develop the disease, they can be a risk for the human health.

In conclusion, *Salmonella* spp was present in the farm studied. The B serogroup presented three of the serotypes most commonly found in humans *S. typhimurium*, *S. agona* and *S. heidelberg*. The serogroups here studied were resistant to Lyncomycin, Kitasamicin and Amoxicillin antibiotics.

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