

Incidence and Drug Resistance of Salmonellae
in Scouring Pigs in Taiwan ROC
Frank S. Hsu, L. L. Chuech and Y. M. Shen
Department of Veterinary Medicine, Animal Industry Research
Institute TSC, Chunan, Miaoli, Taiwan 350 ROC

Although studies in the prevalence of salmonellae and the salmonella carrier state in healthy slaughter pigs have been carried out before in Taiwan ROC, little information is available on the scouring pigs from the intensive pig farms in Taiwan ROC. An increasing incidence of drug-resistant salmonella strains has been reported when using these drugs for therapy, prophylaxis or growth promotion and thus may have implications for public health. This study was made in an attempt to investigate the prevalence of salmonellae among pigs from various districts of the country and to describe the drug resistance patterns of salmonella isolated.

The nine intensive pig farms distributed throughout the country. Each contains 10,000 to 60,000 pigs. The drugs used in these farms for prophylaxis, therapy or growth promotion were tetracyclines, kanamycin, sulfa drugs, chloramphenicol, streptomycin, ampicillin and neomycin. During the period between September 1979 and May 1980, rectal swaps samples were collected: 1) from 537 nursing pigs, 6 to 8 weeks old; 2) from 34 growing pigs, 8 to 16 weeks old; 3) from 33 suckling pigs, 4 to 14 days; and 4) from 16 sows nursing those baby pigs. In addition, a total of 45 samples of gall bladder wall and mesenteric lymph nodes were obtained from the feeder pigs which had died of scouring.

Both fecal swap and tissue samples were collected aseptically. The fecal swaps were placed into slip-cap test tube which contained 10 ml of tetrathionate broth (Difco), or selenite broth (Difco, B273), or Rappaport broth (Merck) for enrichment. Both tetrathionate and selenite broths were incubated at 43°C, while Rappaport broth was incubated at 37°C as recommended by Harvey. After 18 hr, subcultures were made on McConkey agar, salmonella-shigella agar (Difco) and bismuth sulfite agar (Difco), and incubated overnight at 37°C. Three colonies presumed to be salmonellae were picked up from each plate and transferred to McConkey agar for purification. Isolants suspected of being salmonellae were inoculated into triple sugar iron agar (Difco, B265), and subjected to the usual biochemical and serological tests. Serological differentiation was carried out with salmonella anti-O and anti-H sera from Difco, U.S.A. and Behringwerke AG, Germany.

Drug susceptibility testing of salmonella isolate was done as previously described by Bauer et al. The following drug disks (Baltimore Biological Laboratory) were used: Sulfathiazole (30 ug), tetracycline (30 ug), streptomycin (10 ug), chloramphenicol (30 ug), kanamycin (30 ug), carbenicillin (30 ug), ampicillin (10 ug), neomycin (30 ug), nalidixic acid (30 ug), colistin (10 ug), polymyxin B (300 units) and gentamycin (10 ug). Plates were incubated for 18 to 24 hr at 37°C. Any inhibition zones with diameters less than the maximum defined as "Intermediate" by Bauer et al were interpreted as "Resistant". For daily control of susceptibility *Escherichia coli* ATCC 25922 and *Staphylococcus aureus* ATCC 25923 (Difco Bacterol-Disk Set B, 1629-32) were used at test cultures described.

Results

Salmonellae were isolated from 54 (10.1%) of the 537 nursing pigs and from 8 (23.5%) of the 34 growing pigs. In two nursing pigs, two different serotypes were isolated from one animal. However, salmonellae were not isolated from any samples collected from suckling pigs and from the sows nursing those piglets. The 65 salmonellae belongs to 10 different serotypes. *S. typhimurium* was the serotype most frequently isolated (27= 41.5%), followed by *S. stanley* (14= 21.5%) and *S. Panama* (7= 10.8%). Of the 45 samples of tissue examined, 24 (53.3%) were positive for salmonellae. The salmonellae belonged to 7 serotypes. *Salmonella typhimurium* was the serotype most frequently isolated accounting for 12 strains, *S. choleraesuis* (5 strains) was the

second most frequent serotype.

Of the 89 salmonella isolates tested for drug resistance, 4 (4.5%) were sensitive to all 12 drugs tested, but the remaining 85 (95.5%) were resistant to at least one or more drugs, 53 (59.6%) were resistant to over five of the drugs. Resistance ranged from a high of more than 95.5% for sulfathiazole to lows of 2.2% for nalidixic acid. However, all of the salmonella isolates were sensitive to colistin, polymyxin B and gentamycin. Among strains of salmonellae, the predominant pattern of resistance was to ampicillin, chloramphenicol, kanamycin, streptomycin, sulfathiazole and tetracycline, accounting for 34 strains; the next most frequently observed pattern was to streptomycin, sulfathiazole and tetracycline accounting for 19 strains, another resistance pattern was to kanamycin, sulfathiazole and tetracycline accounting for 12 strains. All 39 strains of *S. typhimurium*, 4 strains of *S. worthington* and 15 strains of *S. stanley*, were resistant to all 6 antibiotics mentioned above. In the same study, 100% of 4 strains of *S. tsevie* were resistant to five of the 6 drugs tested. The majority of the isolates of *S. panama* and *S. weltevreden* were sensitive to chloramphenicol, ampicillin and kanamycin, and the isolates of *S. cholerae-suis* were sensitive to ampicillin and chloramphenicol.

Conclusion

The rectal swap survey revealed salmonellae in 62 (10.6%) of 571 scouring feeder pigs. Salmonellae isolated belonged to 10 different serotypes. Of these, *S. typhimurium* was the serotype most frequently isolated, followed by *S. stanley* and *S. panama*. Of 45 feeder pigs with enteric disorder necropsied, 24 (53.3%) were positive for salmonellae. Salmonellae isolated belonged to 7 different serotypes. Of these, *S. typhimurium* was the most common serotype (50%) and *S. choleraesuis* appeared to be the second. Of 89 salmonella isolates examined for drug susceptibility, 95.5% were resistant to one or more drugs. Resistance to sulfathiazole was most common (95.5%), followed by tetracycline and streptomycin (87.6% each). The predominant pattern of resistance was to ampicillin, chloramphenicol, kanamycin, streptomycin, sulfathiazole and tetracycline (34 strains). The next most frequent pattern was to streptomycin, sulfathiazole and tetracycline (19 strains).

Selected references: Cheng, C.M. et al. 1968, Chin. J. Microbiol. 2:13; Hummel, P.H. et al. 1978, Chin. J. Microbiol. 11:93; Hummel, P.H. et al. 1979, Memoirs of the College of Agr., Natl Taiwan Univ. 19:45; Bayer, A.M. et al. 1966, Am. J. Clin. Path. 45:493; Lennete, E.H. et al. 1974, Manu. Clin. Microbiol. Am. Soc. Microbiol. Sojka, W.J. and C. Wray. 1980, Br. Vet. J. 136:463; Pocurull, D.W. et al. 1971, Appl Microbiol. 21:358.