HORIZONTAL TRANSMISSION OF *SALMONELLA CHOLERAESUIS* IN
WEANED PIGS EXPOSED TO DIFFERENT CHALLENGE LEVELS

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*Salmonella choleraesuis*, the serotype most often isolated from swine in the United States, is the agent responsible for swine paratyphoid. As a host adapted pathogen, *S. choleraesuis* is rarely isolated from sources other than swine and thus is spread primarily via horizontal transmission from diseased or asymptomatic carrier animals (Schwartz, 1990). Carriers persistently colonized by *S. choleraesuis* have been shown to shed the pathogen in their feces for up to 12 weeks post inoculation (Gray et al., 1996b) and that *Salmonella*-free pigs can be infected following exposure to infected pigs shedding $10^8$ CFU *S. choleraesuis*/g of feces (Gray et al., 1996a). Recurrent shedding by carriers can be stimulated by events such as recent transport, parturition, or weaning (Gray and Fedorka-Cray, 1996). In many production settings, weaned pigs from different litters are commingled and thus shedding by even one pig can result in transmission to many.

Competitive exclusion technology, the exclusion of enteric pathogens from the alimentary tract of swine by preferential colonization with mutualist and commensal microbes, is an attractive strategy to reducing *Salmonella* infection of swine. Such technology has been proven effective in enhancing colonization resistance of avian species to *Salmonella* and *Escherichia coli* (Nisbet et al., 1996a; 1996b). As expected, shedding of the pathogens was also reduced which decreased the potential for horizontal transmission. With the exception of the recent study by Gray et al. (1996a), horizontal transmission between pigs has received little attention experimentally, and only with older pigs (40 days of age or older). Because this area remains a high research priority, we present results from an experiment designed to establish a model to study horizontal transmission of *S. choleraesuis* between recently weaned 14 day old pigs.

METHODS

Thirty fourteen-day old pigs were weaned and randomly allocated into groups designated as low seeders, medium seeders or high seeders (10 pigs/group). Each pig in their respective group was inoculated per os with a novobiocin and nalidixic acid resistant *Salmonella choleraesuis* variety kunzendorf at $8 \times 10^4$, $10^6$, or $10^8$ CFU. Inoculation occurred

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one day post weaning. One day post inoculation, each group was commingled with ten newly weaned pigs (14 days old) previously unexposed to the challenge organism. These later pigs were designated as contacts. Rectal swabs were collected daily for 7 to 8 days post inoculation at which time all seeders (7 days post inoculation) and all contacts (7 days post commingling) were necropsied and tonsils, ileocolic lymph nodes, ileocolic junction, and cecal contents were collected. Each swab or sample (0.2 to 2.0 g) was preenriched in GN-Hajna broth, further enriched in Rappaport-Vassiliadis broth and plated on Brilliant Green Agar medium containing novobiocin (25 µg/ml) and nalidixic acid (20 µg/ml) for selective differentiation. Each step of enrichment and differentiation was accomplished at 37°C during 18-24 h incubation. Plates were examined for the presence of salmonellae-like colonies and suspect colonies were further tested by agglutination with Salmonella O Antiserum (Group C, Factors 6 and 7). Cecal contents were also serially-diluted and plated on Brilliant Green Agar containing the two antibiotics to quantify the challenge strain. Wildtype salmonellae were not detected following cultivation of rectal swabs collected one day prior to inoculation and commingling; these were cultured qualitatively as described above except selective differentiation was accomplished without nalidixic acid.

RESULTS AND DISCUSSION

A dose dependent response was observed with the groups inoculated with increasing concentration of *Salmonella choleraesuis* (Table 1) and the results have been discussed in more detail elsewhere (see paper by Anderson et al. presented at

Table 1. Horizontal transmission of *Salmonella choleraesuis*; from pigs orally challenged with *Salmonella choleraesuis* (seeders) to naive pigs (contacts)

<table>
<thead>
<tr>
<th>(Dose given)</th>
<th>Seeder$^a$ infected (of 10 challenged)</th>
<th>Contacts$^a$ infected (of 10 exposed)</th>
<th>Seeder Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low seeder (10⁴ CFU)</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Medium seeder (10⁶ CFU)</td>
<td>4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>High seeder (10⁸ CFU)</td>
<td>10</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

$^a$Pigs dosed orally with *Salmonella choleraesuis* at 14 day of age were designated as seeders.

$^b$Pigs previously unexposed to *Salmonella choleraesuis*, designated as contacts, were commingled with seeders one day after the seeders were challenged.

this symposium). Horizontal transmission occurred between the contacts commingled with the high seeder group, those inoculated with 10⁸ CFU *S. choleraesuis* (Table 1). Of the three
contacts infected, *S. choleraesuis* was recovered from the ileocolic lymph nodes of all three and the cecal contents of one; the concentration of *S. choleraesuis* in the cecal contents was 2.3 log$_{10}$ CFU. *Salmonella choleraesuis* was not recovered from tonsils or the ileocolic junction of any of those pigs designated as contacts and shedding of *Salmonella* by these pigs was not observed. Horizontal transmission was not observed between contacts and seeders within either the low or medium seeder groups, presumably because of the very low incidence of shedding (see paper by Anderson et al. presented at this symposium).

REFERENCES


