

# Prevalence of *Salmonella* spp. in the feces on farm and ceca at slaughter for a cohort of finishing pigs

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## Abstract

To help producers decide whether they should withdraw feed prior to slaughter, we designed a study that examined the effect of feed withdrawal on the proportion of gastrointestinal tract lacerations, prevalence of *Salmonella* spp. in cecal contents at slaughter, prevalence and severity of gastric ulcers, and meat quality as measured by ultimate pH, color, and water holding capacity. Finally, we analyzed the economic impact of the treatments. This report focuses on the prevalence of *Salmonella* spp. in feces on the farm and cecal contents at slaughter.

We followed to slaughter, in 3 marketing groups, 900 National Pig Development barrows that we had assigned to treatment. Each marketing group (feed withdrawn once, first group; twice, second group; or three times, third group) had an equal number of pigs that had feed withdrawn for 0 (control) 12, or 24 hours. Overall, 62% of cecal samples were positive for *Salmonella* but isolation was not associated with feed withdrawal. This indicates that feed withdrawal prior to slaughter did not increase the prevalence of *Salmonella* as reported in previous experimental studies.

## Introduction

To compete in today's global markets the USA pork industry is rapidly changing from treating pork as a commodity product to one focused on quality. The outbreak of *E. coli* O157:H7 in 1993 increased government and industry focus on enhancing the safety of meat and led to the adoption of HACCP principles to improve pork quality.

To decrease the proportion of PSE pork, Eikelenboom (1991) recommended producers to withdraw feed from hogs 12-24 hours prior to slaughter (1). Because producers are penalized for selling hogs outside a narrow weight range, most who have all-in/all-out facilities send their hogs to slaughter over 3-4 weeks. Usually, they withdraw feed from the last load but earlier loads are on full feed until they are shipped. The benefits of feed withdrawal are not without risks including a possible rise in the proportion of pigs with gastric ulcers or an increase in the proportion of pigs excreting *Salmonella* spp.

Although slaughter equipment is often the immediate

source of contamination, the initial source is the carrier pig and transmission is thought to occur by pig-to-pig contact or from exposure to the contaminated environment. The handling and transport of pigs prior to slaughter has long been recognized as increasing the prevalence of *Salmonella* spp. To counteract these inherent risks researchers have been investigating techniques that may decrease the risk of contaminating carcasses. Withdrawing feed from hogs before slaughter decreases the weight (2, 3) and presumably solid contents of the gastrointestinal tracts. Consequently, because they are lighter, slaughtermen are less likely to lacerate them during evisceration resulting in decreased carcass contamination (3). However, feed withdrawal may be stressful and may increase the proportion of pigs excreting *Salmonella* spp.

## Materials and Methods

**Subjects:** In March 1998, 1133 National Pig Development (NPD) barrows from a nursery site were weighed, individually identified and assigned, blocked by weight, to 36 pens. The barn had 40 pens and the other 4 pens were used to hold the cull pigs and the extreme lightest and heaviest pigs that were excluded from the study. Each pen of 29-32 pigs had pigs of similar minimum and maximum weight with similar variation between pens. Maximum variation within a pen, rather than minimum, allowed us to progressively select the heaviest third of pigs for slaughter from each pen and simulate the slaughter close-out of a barn of pigs where on about three occasions the heaviest third in the barn are taken to slaughter. By design, however, this procedure confounds the effects of repeated feed withdrawal with pig weight because the lighter weight (presumably slower growing) pigs are excluded from the first marketing group. In June, the 6 pens that had the fewest pigs (attrition from death and culling) were deleted from the study because they exceeded our needs, leaving 900 pigs.

***Salmonella* status:** In February, 1998, we selected a nursery site that we had previously screened to ensure the pigs were *Salmonella* positive. After placement at the finishing site, we collected fecal samples on May 18-19, 1998 from about 2/3 individual pigs in all 36 pens and tested them for salmonella. On June 8-9, 1998 we collected fecal samples from the 30 pens remaining in the study.

Experimental design: A 3 by 3 factorial.

Treatments: Treatments included feed withdrawal of 0, 12, and 24 hours and marketing group (1, 2, and 3) selected visually on weight and having feed withdrawn once, twice, or three times prior to shipment. Treatments were allocated at random, blocked on pen prevalence of *Salmonella* spp. as determined from the fecal sampling in May and June. Feeders to the pens containing hogs for slaughter were shut off and any feed in the feeding troughs was returned to the pens' feeders.

Shipments: For the first and second marketing groups, the 10 heaviest pigs in each pen were visually identified and shipped (feed withdrawn once or twice). The third marketing group closed out the barn and consisted of all pigs remaining in all the test pens. In the second marketing group, an accident at the packing plant resulted in the loss of all data on all the pigs (60) for that day. Pigs were individually tattooed with a unique 4 digit identifying number coded to describe the day and treatment. Time in transport and lairage were recorded by the person accompanying the pigs. In lairage, pigs had free access to water but not feed.

Gastrointestinal tracts (GIT): Standard evisceration procedure at the plant was as follows: the head was removed, the brisket cut open, the abdominal cavity opened, the anus (bung) dropped, then the gastrointestinal tract and thoracic cavity contents (pluck) were cut from the carcass and placed on a tray. Immediately the abdomens were opened we tagged the gastrointestinal tracts with temporary paper numbered tags which we could correlate to the carcass tattoos. The gastrointestinal tracts were then removed from the viscera trays, placed in plastic bags and taken off-line for us to examine.

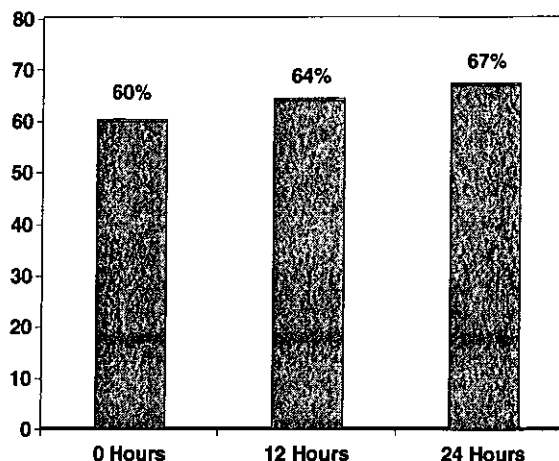
Cecal samples: Each cecum was opened and 10 gm samples of cecal contents were collected and transported to the laboratory in Raleigh. To detect *Salmonella* organisms, all samples were treated by the standard techniques previously reported (4).

Statistical Analyses: All data were analyzed in SAS using the PROC FREQ and PROC MEANS procedures (5).

## Results

Pigs were loaded and left the farm between 2-5am, traveled for 1hr 15 min (range: 48 min to 1 hr 45 min) and held in lairage for 3hr 50 min (range: 1 hr 58 min to 4 hr 47 min). Overall, 62% of cecal samples were positive for *Salmonella*. Isolation of *Salmonella* was not associated with hours of feed withdrawal (Figure 1) but was related to the marketing group (number of times feed was withdrawn).

Figure 1. Percentage of cecal samples positive for *Salmonella* by hours of feed withdrawal.



## Discussion

Our results indicate that feed withdrawal 12 or 24 hours prior to loading does not increase the percentage of cecal samples positive for *Salmonella* post-slaughter.

These findings support the hypothesis that the prevalence of *Salmonella* in pens of pigs in finishing barns is a poor predictor of prevalence of *Salmonella* at slaughter. Transport (6) and lairage (7) along with close contact with other pigs are likely more important determinants of *Salmonella* prevalence at slaughter.

The pattern of *Salmonella* isolations over time in the finishing barn indicate that many pigs that were excreting *Salmonella* in May had stopped by June. This trend is in accordance with Oosterom and others, 1981, who reported that when pigs become infected with *Salmonella* they gradually stop excreting over 9 weeks (8). If this trend of decreased excretion continued from June until when all pigs were slaughtered, it could explain the decrease in percentage of *Salmonella* positive cecal samples from the first group slaughtered (73%) to the last group (52%). Our results concur with findings from experimental *Salmonella* infections of pigs which indicate that fecal shedding declines over time.

A limitation of our study is that we may have overestimated the true prevalence among treatments of cecal *Salmonella* at slaughter because pigs of all feed withdrawal treatments (0, 12, and 24 hour) were daily transported to slaughter on the same truck and shared the same lairage.

The increased stocking density combined with the stress involved may have led to cross-infection with *Salmonella* among the treatments. During transport and lairage an initial *Salmonella* infection of the tonsils may reach the colon and rectum in 2 hours which is less than the 5 hours our pigs were in transport and lairage (8, 9).

## References

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