The Link between Feed & *Salmonella*

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Salmonella

*Salmonella* is the genus name for a large number (over 2,500) of types of bacteria.

- *Salmonella choleraesuis*
  - severe signs of diarrhea and septicaemia
- *Salmonella Typhimurium*
  - mainly clinical signs of diarrhea
- Asymptomatic swine

Implications of continued shedding:
Environmental contamination
Within-herd transmission
Transmission to other herds

All lead to increased risk of transmission to humans
Feed as a contamination source

Problem: *Salmonella* carriage in pigs is a significant food safety issue, as *Salmonella* can be transmitted to humans via carcass contamination at slaughter. Contaminated feed has been highlighted as a possible source of *Salmonella* infection in pigs.

Aim: Monitor incidence of *Salmonella* in feed, as in a ‘Farm to Fork’ food safety concept, safe feed is the first step in ensuring safe pork.
Possible sources of contamination

Storage → Supplier specific Processes → Loading and unloading

Farm

Feed Mill

Storage → Mixing → Feed Additives

Thermal treatment 60-83°C, 10sec-1min

Drying Moisture <15%

Storage

Transport

Compound feed

Farm

Feed Mill
Sources of contamination within the Feed Mill

Objectives

- Investigate *Salmonella* carriage at each production stage on 10 commercially high *Salmonella* seroprevalence pig farms

- Assess occurrence of *Salmonella* in pig feed on commercial farms and the role of feed in *Salmonella* transmission

- Assessment of pig feed and ingredients at commercial feed mills for occurrence of *Salmonella* and *Enterobacteriaceae*
Materials and Methods-Farm

- 10 commercial pig farms, (A-F)
- >50% sero-prevalence in National Pig *Salmonella* Control Programme

- Gilts and Dry sow
- Farrowing sow
- First and Second Stage Weaners
- Finishers

Faeces (composite)
Feed (50-100g)
Pen Swab
Water (500ml)
Water drinker swab
Trough swab

*Salmonella* isolation by ISO 6579:2008

PCR confirmation
Antimicrobial Resistance
PFGE and MLVA

The Irish Agriculture and Food Development Authority
Materials and Methods - Feed Mills

- 5 commercial feed mills and 1 home compounder

Feed ingredients (n=340)
- Cereals
- Vegetable protein sources
- By-products of oil extraction and ethanol production

Compound feeds (n=313):
- Meal and pelleted feed for all stages of pig production

- Monthly sub samples (150g) from every ingredient load and finished feed batch
- Salmonella (ISO 6579:2008) and Enterobacteriaceae (EN ISO 7218-3:2007)
Farm Results

2985 samples taken

- 14.9% faecal/pen on 9/10 farms
- 2.4% feed
- 7.9% environment

Prevalence per stage
Weaner 1 – 16.7%
Weaner 2 – 22.5%
Finisher – 29.7%
Gilts – 18.8%
Dry sows – 10.4%
Lactating sows – 1.5%
Key Points-Farm

Farm:
- *Salmonella* isolated in all production stages
- 11 different serovars
  - monophasic variant of Typhimurium (4,[5],12:i:-) 123/290 (42%)
- Positive feed found on six farms
- 5 different serovars
  - 4,12:i:-, Derby, Typhimurium, Typhimurium Copenhagen, and Tennessee.
- All were multi-drug resistant
Feed Mill Results

- *Salmonella* isolated from 2 ingredients (wheat and soybean meal) at 2 mills
- 3 compound feeds (dry sow meal and pellets and finisher meal)

- Overall contamination rates: 0.6% (2/338) feed ingredients and 0.95% (3/317) compound feed

- Isolates were all monophasic variants of *Salmonella* Typhimurium

- Pattern of resistance (2-7 antimicrobials).

- *Enterobacteriaceae* were detected in 92% of meal samples and 29% of pelleted feed samples
Molecular Fingerprinting

Farm J

Farm B
Implications

Has the feed contamination observed come from the commercial feed or as a result cross contamination on the farm?

Monophasic variant of *Salmonella* Typhimurium was the dominate serovar in both the pig herds and the mills.

YES!!!! Mill and farm feed sample serovars shown by molecular fingerprinting to have identical profiles.
Conclusions

- 14/585 (2.4%) feed samples *Salmonella* positive across all stages

- Overall feed mill contamination rate of <1%, *on-farm* risk factors also present for contamination of feed

- Serovar 4,[5],12:i:- (40.9%) emerging food safety concern in Europe (EFSA, 2010)

*Feed cannot be ruled out as risk factor in epidemiology of Salmonella*

*Therefore…*
*Feed - essential component of any control program*
The research on *Salmonella* continues in Teagasc…

“Low cost solutions to control *Salmonella*”

- Farm interventions (administration of acids in feed)
- Slaughterhouse actions (improvement of cleaning methods at lairage)

- Estimation of the cost of the infection to the farmers
- Farming practice risks and preventive actions to control *Salmonella* in Irish herds

We require your help to develop this tasks

- Please fill the questionnaire during the day. It takes only 5-10 minutes and return them to Hector Arguello.
- Or bring it home and enclose it in the envelope with the other questionnaire

*Your cooperation is greatly appreciated.*
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Thank You for Listening

Any Questions??