Reduction in level of Salmonella on swine carcasses after slaughter without splitting the head.

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Summary: The purpose of this study was to examine the effect on the prevalence of Salmonella bacteria on the carcass when leaving the tongue in the intact head and thereby reducing the risk of transferring Salmonella bacteria from the oral cavity, pharynx etc. to the carcass, compared to removing the tongue together with the pluck set. Samples were collected from healthy pigs with an expected high risk of Salmonella bacteria in the intestines. When leaving the tongue in the intact head we found a reduction in Salmonella positive carcasses at 30 %, even though the reduction was not statistically significant because of high variation in the day to day number of Salmonella positive carcasses.

Keywords: Slaughter, tongue removal, pathogen reduction, meat inspection.

Introduction: If a pig herd carries an intestinal pathogenic organism, the oral cavity, pharynx and lymphatic tissue of the pig carcasses after slaughter can be contaminated with this organism. With traditional Danish slaughter and control methods, the contamination can be transferred to the carcass via these reservoirs, even when the processes are performed correctly. The primary transfer can mainly be related to the removal of the tongue together with the pluck set and possibly to head splitting and cutting into glands and other handling in connection with veterinary meat inspection. To examine the effect of changes in the slaughter processes, an investigation was carried out where the tongue was left in situ in the intact head, and the veterinary meat inspection of the head was performed after the head had been removed from the carcass. The effect of these changes was verified by mapping the transfer of possible Salmonella bacteria onto the carcass. It has been shown earlier (Christensen H. og Lüthje, H., 1994) that removal of intact heads including tongues has a reducing effect on the occurrence of pathogens on the carcass. However these investigations did not show a clear effect on Salmonella, as the level of Salmonella bacteria on the carcasses from the test batch
in that study was too low. We therefore performed a new study on carcasses from healthy pigs from herds with a relative high risk of Salmonella.

**Materials and Methods:** In Denmark, when slaughtering pigs, the tongue is removed with the pluck set. In this project the tongue was left untouched in the head until the head was removed from the carcass. This involved alterations at the following operations: **Pluck removal** Pluck set (minus the tongue) was removed by cutting the larynx leaving the tongue untouched in the head. **Splitting:** The head was not split. **Cutting/loosening of head in neck:** The head was loosened in the neck by cutting the joint between the head and the first cervical vertebra. **Removing of head:** The head was removed immediately before chilling, head and tongue were condemned. **Meat inspection:** The intact heads were inspected on the outside in connection with the regular conveyor control. After removal, the head was placed on a table and the meat inspector examined the head by making cuts into the submandibular lymph nodes and surveying accessible mucous membranes. If this survey revealed conditions, which required retention of the carcass for secondary inspection, the carcass was labelled with a retention slip.

The project was performed at one slaughterhouse at days when healthy pigs were slaughtered from herds with high risk of Salmonella (herds with a relatively high level of *Salmonella* antibodies = level 3 herds.) The test period was approx. six months. During this period, intact heads with tongues were removed every second week (test batch). During the remaining weeks, the heads were treated normally (control batch). The effect of the changed pluck removal was documented by swabs (total swabbing area pr. carcass: 1,400 cm²) collected each day from 20 to 60 carcasses after slaughtering but before chilling. All swabbing (from both test and control batches) was done as separate front part swab (approx. 400 cm²: carcass opening cut face from the caudal to the cranial end of sternum incl. 5 cm of the adjoining rind) and a hind part swabs (approx. 1,000 cm²: pelvic duct, the medial face of the hind leg incl. 5 cm of the adjoining rind and the carcass opening cut face down to the caudal part of sternum incl. 5 cm of the adjoining rind). All 1,157 samples were analysed qualitatively for Salmonella using the EiaFoss method. In addition 950 samples were examined semi-quantitatively according to NMKL (Nordic Committee for Food Analysis) method no. 71 as modified by the Danish Veterinary and Food Administration. The semi-quantitative analysis consisted of analysis for presence of Salmonella in 100 ml, 10 ml and 1 ml of sample.

**Results:** The proportion of Salmonella positive carcasses was calculated per day of slaughter for test and control batches. A carcass was defined as positive if a front
part or hind part swab or both were Salmonella positive. There was a very big variation for the individual days of slaughter for both control and test batches. The results show a reduction in the presence of Salmonella on carcasses (where one or both carcass swabs are positive) from 37% for the control batches to 26% for the test batches (reduction: approx. 30%). A statistical analysis was carried out where the dependent variable is the proportion of positive carcasses for the day in question and the explanatory variable is test batch or control batch (method: logistic regression model (SAS, Proc Genmod). Assumed over-dispersion is handled by using the p-scale option.). The statistical analysis shows that the difference is not significant (p=0.19). There was a big difference in the share of positive carcasses on the individual days of slaughter, and this difference did exceed by far the variation between test batch and control batch. The experiment was stopped after six months as it was assumed that additional analyses would not change the result substantially.

The number of Salmonella organisms on contaminated carcasses from test and control batches was the same. The number of Salmonella organisms per 1,400 cm² was: 1) less than 20 Salmonella organisms on approx. 50% of the positive carcasses, i.e. <0.014 Salmonella organism per cm², 2) between 20 and 200 Salmonella organisms on approx. 30% of the positive carcasses, i.e. <0.14 Salmonella organism per cm², 3) higher than 200 Salmonella organisms on approx. 20% of the positive carcasses i.e. more than 0.14 Salmonella organism per cm².

Discussion/Conclusion: The large variation from day to day is observed at all slaughterhouses where pigs from level 3 herds are being slaughtered in Denmark. The variation is probably caused by two factors: 1) The number of Salmonella organisms in the alimentary tract varies substantially between herds/pigs. 2) Despite the postponement of removal of the tongue, it is still possible for processes, operatives and meat inspectors to contaminate the carcass with Salmonella during the removal of pluck sets, meat inspection, loosening of jowls and neck cleaning. Nevertheless this study shows a 30 % reduction in Salmonella positive carcasses, by leaving the tongue in the unsplit head, and is therefore an important pathogen reducing process. The results of quantitative analyses showed that the number of Salmonella bacteria on carcasses from level 3 herds generally is low.

References