



IPVS2022

26th international pig veterinary society congress - rio de janeiro - brazil



June
21st-24th

Proceedings IPVS2022

RIO DE JANEIRO/RJ, BRAZIL

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www.ipvs2022.com



Microbiological quality of pig carcasses in a slaughterhouse under risk-based inspection system

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Introduction

Meat product inspection procedures are adopted to guarantee food quality and safety for consumption (1). Due to technologies and regulations advancement for farming and slaughtering pigs, a change in zoonotic profile attributed to pork has been identified (2,3). Frequently detected lesions during inspection procedures have no impact on public health, while the palpation and incision techniques used favor bacterial cross-contamination (2,4,5,6,7). This change in the zoonotic profile turns out necessary to review the inspection procedures according actual public health hazards based on risk analysis. Thus, a global movement began to establish inspection parameters based on epidemiological risk profiles, culminating in the publication of Normative Instruction 79 in Brazil in 2018 (8). In order to assess microbiological contamination when adopting a risk-based inspection system, the occurrence of *Salmonella* spp. and the quantification of enterobacteria and mesophiles were compared in pig carcasses slaughtered under traditional and risk-based inspection systems.

Materials and Methods

Swab samples were collected for five days from pig carcass inspected under the traditional system and for five days under the risk-based system, always at 5:30 am, 8:30 am, 11:30 am, and 2:30 pm. At each time and date, samples of five carcasses were collected, achieving 20 carcasses per day per inspection system and on total 200 carcasses throughout the experiment.

The sampling procedure was carried out based on Brazilian legal requirements by rubbing a sterile sponge on four points of each carcass (ham, belly, loin, and axillary region), totaling 400 cm² (9). Each sample was tested for enterobacteria and mesophile counts and *Salmonella enterica* presence. (10,11,12).

A Fisher's exact test was performed to compare *Salmonella enterica* results between the two inspection systems. Shapiro-Wilk, Kolmogorov-Smirnov, Cramer-von Mises, and Anderson-Darling tests were performed to assess the normality of the enterobacteria and mesophiles results and Wilcoxon test to compare the inspection systems. The sample collection times were compared using Kruskal-Wallis test, followed by Wilcoxon test when the former presented significant results ($p \leq 0.05$) (13).

Results

A statistical reduction was identified for the quantification of enterobacteria (log 0.47 to 0.23 CFU/cm²) and mesophiles (log 1.87 to 1.55 CFU/cm²) in pig carcass inspected under risk-based system. The

occurrence of *Salmonella enterica* did not show statistical significance (4% to 5.3%). There was no statistical significance when comparing time effect.

Discussion and Conclusion

Pig carcass inspected under risk-based system showed lower enterobacteria and mesophiles counts when compared to traditional system. It can be suggested that these results reflect the reduction in carcass handling, less exposure of contaminated tissues due to the complete removal of the head, and the suppression of cuts in carcass and head lymph nodes. Regarding *Salmonella* spp., no differences were found between the inspection systems. Both inspection systems rendered results within the legal accepted limits (9).

The results allowed us to conclude that adopting risk-based inspection systems improves food safety through enterobacteria and mesophile reduction. Future studies using similar analyses methods are indicated after the official implementation of this new inspection system.

Acknowledgments

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EMBRAPA Suínos e Aves, Concórdia, Brazil;
Finance code 001, Coordination for the Improvement of Higher Education Personnel, Brazil (CAPES).

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