

# Bacterial sanitation status of pork processed by the automated pork thigh deboning machine

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**Objectives:** In Japan, the working-age population (15–64 years old) will decrease from 59.1% of the population (74.06 million) in 2020 to 51.8% (52.75 million) in 2050. Labor shortages are expected to become a serious issue. Bone removal work is not a popular occupation for young generations and there is a chronic shortage of labor in the meat packing industry. Meat processing is difficult to automate because carcass size varies widely. A Japanese company has developed an automatic pork thigh deboning device called HAMDAS that determines the bone position by using an X-ray device and cuts at the appropriate position with a knife. HAMDAS was installed in a processing facility in 2016. It has a processing capacity of 500 pig thighs (250 pigs) per hour. Because *Enterobacteriaceae* was detected at the conveyor belt of HAMDAS line before the operation in our previous study (Ebina *et al.*, 2019), cleaning methods of the HAMDAS line were corrected and alcohol were sprayed before the operation as a general hygiene management. In this study we examined bacteriological differences of the devices and carcasses between HAMDAS operation line and human operation line.

**Materials and Methods:** First, we examined total aerobic plate counts (APC) and *Enterobacteriaceae* counts of chilling carcasses that were kept in refrigerator before processing by the destructive method and swab method. At HAMDAS operation line, conveyor belt, clammer that pinch bone head of hamstrings, knives, and circular saw were examined bacterial contamination status by using swab method. The samples at HAMDAS operation line were collected on before start of processing in the morning, 10 AM break time, lunch break at 12AM, 3PM break time and after the processing work. Then, the meat around head of femur and fat surface of pork thigh were also examined bacteriologically before 10 AM break time, lunch break at 12AM, 3PM break time and final processing work. At human operation line, conveyor belt was wiped off by the swab, and the meat and fat surface were collected at the same time as HAMDAS operation line.

**Results and Discussion:** At the 10 chilling carcasses before processing, the mean  $\pm$  standard deviation (SD) of the APC obtained by the destructive method were  $2.01 \pm 0.74$  log cfu/cm<sup>2</sup>, while those obtained by the cotton swabbing method were  $0.4 \pm 0.65$  log cfu/cm<sup>2</sup>. *Enterobacteriaceae* was isolated from 1 of 10 carcass ( $2.09$  log cfu/cm<sup>2</sup>) by the destructive method. APC by the destructive method is higher than that by swabbing method ( $p < 0.01$ ). Before working of HAMDAS operation line, we examined bacterial contamination status at the conveyor belt, clammer, knife, and circular saw by the cotton swabbing method. There are no bacteria detected from the samples. However, APC from the conveyor belt, clammer, knife, and circular saw showed 2.08-2.72, 1.18-2.60, 1.90-2.11, and 1.48-2.16 log cfu/swab, respectively, after working time on 10AM, 12AM, 3PM and 5PM. From the conveyor belt of human operation line, APC were obtained  $-0.05$  log cfu/cm<sup>2</sup> before working, and  $0.24$ - $1.01$  log cfu/cm<sup>2</sup> after 10 AM by the cotton swabbing method. At HAMDAS operation line, APC from meat around head of femur by the destructive method after starting work, before 10 AM break time, lunch break at 12AM, 3PM break time and final processing work were  $0.55 \pm 0.23$ ,  $0.62 \pm 0.31$ ,  $0.33 \pm 0.29$ ,  $0.46 \pm 0.42$  and  $0.32 \pm 0.13$  log cfu/cm<sup>2</sup>, respectively. At the same time of human operation line, APC were  $0.50 \pm 0.29$ ,  $0.38 \pm 0.33$ ,  $0.38 \pm 0.33$ ,  $0.17 \pm 0.30$  and  $0.37 \pm 0.32$  log cfu/cm<sup>2</sup>, respectively. At HAMDAS operation line, APC from fat surface of hamstrings by the destructive method showed  $2.01 \pm 0.07$ ,  $2.18 \pm 0.31$ ,  $1.89 \pm 0.35$ ,  $1.67 \pm 0.36$  and  $1.85 \pm 0.07$  log cfu/cm<sup>2</sup>, respectively. At the same time of human operation line, APC were  $1.91 \pm 0.10$ ,  $2.19 \pm 0.45$ ,  $1.92 \pm 0.28$ ,  $1.62 \pm 0.32$  and  $1.88 \pm 0.47$  log cfu/cm<sup>2</sup>, respectively. APC from the meat and fat surface samples by HAMDAS operation line and human operation line were statistically similar. The *Enterobacteriaceae* counts were also similar, though small number of *Enterobacteriaceae* were isolated from very few samples.

**Conclusions:** There were no differences in APC and *Enterobacteriaceae* counts on processed pork between HAMDAS operation and human operation in this report. The slaughterhouse that introduced HAMDAS making five surplus workers on the bone-removal line. By allocating five surplus workers to the other work lines, the efficiency of cutting work was improved (from 120 heads/hour to 140 heads/hour). In the future, the mechanization of meat processing work may make it possible to reduce the burden on workers and minimize work in low-temperature environments (e.g., 10°C or lower). As a result, it should be possible to extend expiration dates and improve the safety of meat.

## Reference:

Ebina *et al.*, Microbiological survey of Pork Processed by the Automated Pork thigh Deboning Machine. the 40th Annual General Conference of Japanese Society of Food Microbiology, Funabori Tokyo, Nov. 28-29, 2019.

**Key words:** Automatic deboning device, Microbiological survey, Meat processing