Study of the chicken carcass surface cooling during the slaughter air-ventilated chilling step

LAURIAU F. (1), BRAMS E. (2), DELETREZ E. (2), CAPPELIER J. (1), STRUBBIA S. (1), HADDAD N. (1), GUILLOU S. (1), TOUBLANC C. (3), ROUAUD O. (3)
1 Oniris, INRAE, SECALIM, UMR 1014, Nantes, France
2 Oniris, Nantes, France
3 Oniris, Universitde Nantes, CNRS, GEPEA, UMR 6144, Nantes, France

Campylobacter is the most common bacterial foodborne pathogen in Europe. Poultry meat is considered the main source of human campylobacteriosis. To mitigate the health risk, the level of *Campylobacter* contamination of poultry carcasses must be reduced. Acting at the slaughter stage and more particularly at the stage of carcass chilling by ventilated air has been highlight by the French and European food safety authorities during *Campylobacter* exposure assessment as a possible risk mitigation strategy due to the sensitivity of *Campylobacter* to cold, desiccation and oxidative stress.
The aim of this study was to evaluate the influence of the physical parameters of the chilling stage (air temperature and velocity) on the surface temperature of broiler carcasses.
A plastic broiler carcass model was first designed by 3D printing after 3D scanning of a chicken carcass and then fitted with sensors positioned at the neck, tenderloins, wings, front and back of the carcass thighs. The sensors consisted of small aluminium cylinders into which thermocouples were inserted. The model was heated to a temperature of 36°C, then installed in different orientations in a cooling cabinet in which the temperature and air velocity varied between -5 and +5°C, and between 1 and 4 $m.s^{-1}$, respectively. The sensors were calibrated to determine the convective heat transfer coefficient for comparison of their response with the operating conditions.
Decreasing the target air temperature increased the cooling rate of broiler carcasses, but did not change the heat transfer coefficient. Experimented at an air speed of 1 $m.s^{-1}$, the heat transfer coefficient of each sensor varied according to the orientation of the model and thus the direction of the air flow. The neck, wings and back of the thighs were the most favourable areas for heat transfer. Tested only for the sensor in the ventral position of the model, the heat transfer coefficient increased with the air velocity. Coupled with predictive models of *Campylobacter* cold inactivation, these preliminary thermodynamic results could be used to determine the most suitable parameters to reduce the level of *Campylobacter* contamination during the air-chilling step.