Evaluation of the transfer of Listeria monocytogenes: A study at the macroscopic and cellular level

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Abstract

The objective of this work was to study parameters involved in the transfer of *Listeria monocytogenes* from surfaces to foods and vice versa. We evaluated the influence of surfaces (stainless steel and high density polyethylene, HDPE), inoculation method (biofilm growth and attached cells), hydration levels (dry and wet), and foods on listerial transfer. A four *L. monocytogenes* strain cocktail was used to inoculate either processing surfaces or foods as growing biofilms or attached cells. Transfer experiments were performed at a constant contact time (30 s) and pressure (45 kPa). After transfer, cells transferred to surfaces or foods were counted, and the efficiency of transfer (EOT) calculated. ^ Our results showed that when calculating EOTs, data were normalized and the initial inoculation level had no effect on the proportion transferred ($P>0.05$). Material type showed to be a significant factor, with greater numbers of *Listeria* transferring from bologna to stainless steel (EOT=0.49) when compared to polyethylene (EOT=0.28, $P<0.01$). When transfer was conducted from inoculated surfaces to uninoculated food, our results strongly suggested that stainless steel surfaces (EOT=0.52) transferred more *L. monocytogenes* to foods than HDPE (EOT=0.21, $P=0.05$). Regarding the inoculation method, biofilms tended to transfer more *Listeria* to foods (EOT=0.57) than attached cells (EOT=0.16). Transfer from inoculated surfaces to foods was significantly higher for dried biofilms growing on stainless steel (EOT=1.5, $P<0.05$). The effect of hydration level was further evaluated by equilibrating biofilms over saturated salt solutions at 20°C for 24 h (94%, 75%, 58% and 33% relative humidity) prior to transferring. Our work showed that as biofilms become drier, the listerial transfer increased significantly ($P<0.05$). We hypothesize that weakened cell-to-cell and cell-to-surface interactions of biofilms upon drying increases transfer to food products. ^ With the use of AFM we determined that the adhesion forces between colloidal (glass and polyethylene) probes and listerial biofilms. The results showed that the maximum adhesive force to polyethylene (-113.38 nN) was significantly higher than that of glass (-85.42 nN, $P<0.001$). Sanitation practices in food industry must be addressed to avoid biofilm formation. Once biofilms are formed, they are harder to remove and listerial transfer and potential cross-contamination increases. ^

Subject Area

Food science

Recommended Citation