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Editorial Open Access

On the Relevance of Microbial Biofilms for Persistence of *Staphylococcus Aureus* in Dairy Farms

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Editorial

Biofilms are defined as bacterial communities surrounded by a structured extracellular polymeric matrix which is adhered to biotic or abiotic surfaces [1]. Biofilm formation develops in two steps: firstly, a primary attachment occurs onto polymeric surfaces, mediated partly by cell-wall associated adhesins; secondly, cell-cell proliferation forms a multilayered biofilm, mediated by production of extracellular factors [2]. In the food industry, bacterial biofilms are considered a main problem especially in dairy, fresh products, poultry and meat processing plants. Outbreaks of foodborne disease caused by various species of Listeria, Salmonella, and Staphylococcus have been linked to biofilm production [3]. Biofilm production can also increase the resistance of microorganisms to antibiotics.

The ability of *Staphylococcus aureus* to form biofilms provides it an important virulence factor. The bacteria surrounded by a biofilm are more difficult to be removed than those in the planktonic form and, once a biofilm is established, it becomes a source of contamination for products and surfaces. *In vitro* studies indicated that bacterial strains growing in biofilms may become 10-1,000 times more resistant to the effects of sanitizers than the same strain in planktonic form. Moreover, biofilms are capable of releasing planktonic cells from the outer layers, enabling persistent bacterial infection [4]. Microorganisms embedded in biofilms can catalyze chemical and biological reactions that cause metal corrosion in the pipelines and bulk tanks, besides interfering with the efficiency of heat transfer. The time necessary for biofilm formation depends on the frequency of equipment cleaning. Surfaces that are in contact with food products must be cleaned several times a day, and other surfaces in the food production environment, such as walls, may be cleaned at least only once a week. The surface of finished products may be contaminated by direct contact, and the food production environment may indirectly contaminate the finished products via vectors, ventilation and cleaning systems, and food handlers.

The ability of strains isolated from mastitis-causing pathogens to adhere to stainless steel, glass, rubber and polypropylene surfaces has been widely studied. In dairy farms, a recent investigation showed that 42% and 39% of 31 *S. aureus* strains isolated from milking parlor environments were biofilm producers on stainless steel and rubber, respectively, indicating a possible persistence of this pathogen in the milking environment. These findings are of major concern in dairy farms, taking into account the association between the occurrence of biofilms and bovine mastitis [5]. *S. aureus* biofilm-producing strains have shown greater ability than non-biofilm-producing strains to adhere to the mucosa of the mammary gland. Moreover, *S. aureus* strains with phenotypically active genes encoding biofilm components may have the ability to start biofilm production, causing persistent intramammary infections [6].

The mechanism for formation of *S. aureus* biofilms on surfaces is a complex process, resulting from physical-chemical interactions between different components, including material surface properties, surface properties of bacteria and environmental factors. Therefore there is a need for further studies for an effective control of undesirable biofilms in the environment of dairy farms. The main issues should include the initial investigation of the prevalence and identification of *S. aureus* strains with the ability to produce biofilms on materials commonly used in the dairy industry, the evaluation of different concentrations of new and commonly used sanitizers in milk handling and processing lines, and how the natural mixed microbiota influences pathogen reduction during disinfection [7]. Importantly, these studies should be carried out on a regional basis using local dairy herds, since *S. aureus* strains found in the milking environments show considerable variability in relation to various parameters of growth and metabolic activity.

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