6. Perspectives of biofilm in mastitis

Biofilm formation is a complex process involving the aggregation and adhesion of bacterial cells on surfaces, leading to the formation of a matrix that protects the cells from the immune system and antimicrobial agents. This matrix is composed of extracellular polymeric substances (EPS) that are produced by the bacteria and can be composed of polysaccharides, proteins, and DNA.

The presence of biofilm in milk samples has been associated with a higher resistance to antibiotics and a slower response to treatment. This is due to the protection provided by the biofilm matrix, which can hinder the penetration of antibiotics into the biofilm and reduce their effectiveness.

1. Biofilm as a survival mechanism

Biofilm formation is a strategy used by bacteria to survive in challenging environments. These environments can include the complex microenvironments found in the host body, such as the urinary tract, the oral cavity, and the respiratory system. In these environments, bacteria can form biofilms on surfaces, which provide a protective shield against host defense mechanisms and antimicrobial agents.

2. Biofilm in natural environments and its implication in infections

The presence of biofilm in natural environments, such as water bodies, play a crucial role in the dissemination of infectious diseases. Biofilm formation on surfaces such as catheters, heart valves, and prosthetic devices can lead to infections that are difficult to treat due to the presence of biofilm.

The implications of biofilm formation in mastitis are significant. The formation of biofilm in milk samples can lead to a slower response to treatment and a higher resistance to antibiotics. This highlights the importance of understanding the mechanisms of biofilm formation and developing effective strategies to prevent and treat biofilm-related infections.
In biofilm and biofilm-matrix caused by staphylococci, bacterial cells adhere to each other and to the surface forming large aggregates called biofilms. In this regard, Dhanawade et al. (2004) found that 91% of staphylococcal isolates are able to form biofilms in vitro. The ability of staphylococcal isolates to form biofilms in vitro is inversely related to the concentration of deacetylated forms of PNAG. In a more recent study, Dhanawade et al. (2007) demonstrated that 86% of isolates from cows and 75% of isolates of veterinary significance showed biofilm activity in vitro as defined by the Screening Test for Biofilm Formation (O’Toole et al., 2000). In this test, bacterial cells were grown in microtiter plates containing polystyrene microplates (Becton Dickinson). In the absence of PNAG, the cells form biofilms with a high degree of adhesion, while in the presence of PNAG, they form biofilms with a low degree of adhesion.

The correlation between the production of SAAC and the ability of staphylococcal isolates to form biofilms is comprised of 58% (w/v) polysaccharide and 42% (w/v) protein. The experimental vaccines in a study by Amorena et al. (2007) is comprised of a mixture of slime (biofilm exopolysaccharide matrix) and whole cell. This vaccine was shown to induce high and long-lasting titres of anti-SAAC antibodies in the mice that received it, with similar results to the vaccine antigens, with the advantage of being able to induce protective immunity in a wide range of strains of S. aureus. The results of a study conducted by the author showed that anti-SAAC vaccine can induce protective immunity in the presence of all strains of S. aureus, including the strains that are resistant to antibiotics.

4. Implication of biofilm in ruminant mastitis caused by S. aureus

In bovine and ovine mastitis caused by staphylococci, bacterial cells adhere to each other and to the surface forming large aggregates called biofilms. In this regard, Dhanawade et al. (2004) found that 91% of staphylococcal isolates are able to form biofilms in vitro. The ability of staphylococcal isolates to form biofilms in vitro is inversely related to the concentration of deacetylated forms of PNAG. In a more recent study, Dhanawade et al. (2007) demonstrated that 86% of isolates from cows and 75% of isolates of veterinary significance showed biofilm activity in vitro as defined by the Screening Test for Biofilm Formation (O’Toole et al., 2000). In this test, bacterial cells were grown in microtiter plates containing polystyrene microplates (Becton Dickinson). In the absence of PNAG, the cells form biofilms with a high degree of adhesion, while in the presence of PNAG, they form biofilms with a low degree of adhesion.

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