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Lactic acid bacteria inhibits quorum sensing and biofilm formation of *Pseudomonas aeruginosa* strain JUPG01 isolated from rancid butter

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ABSTRACT

The majority of pathogenic bacteria utilize cell to cell communication mechanisms to regulate the cell density and expression of virulence factors. Therefore, quorum sensing system could be one of the targets for antimicrobial strategy to control quorum sensing regulated phenotypes in the pathogenic bacteria. Several lactic acid bacteria produce peptides and secondary metabolites having antimicrobial properties. In the present study, exopolysaccharides (EPS) and secondary metabolites from the Lactic Acid Bacteria (LABs) isolated from various sources such as cow milk, sourdough, chicken intestine, buttermilk, roasted meat and idly batter were screened for quorum quenching properties against *P. aeruginosa* strain JUPG01isolated from rancid butter. The results revealed that EPS from LABs were not significant against screened quorum quenching activity. However, the secondary metabolites extracted from *Pediococcus pentosaceus* strain BS-2 and *Lactobacillus fermentum* strain BM-2isolated from cow milk exhibited significant quorum quenching activity. Furthermore, the strains BS-2 and BM-2 revealed significant anti-biofilm activity against *P. aeruginosa* strain JUPG01. This study highlights the biotechnological applications of LABs in the eradication of *Pseudomonas* species associated with dairy food contamination and spoilage.

1. Introduction

Microorganisms responsible for infecting humans and animals are considered a major concern in food spoilage due to inappropriate handling practices cause tremendous economic losses and pose serious public health complications (Dhama et al., 2013). Biofilm formation by food borne pathogens is of serious concern in the food industry, even with the most sophisticated food preservation techniques, the majority of the food is lost due to microbial spoilage (Galié et al., 2018). Food borne bacteria such as *Bacillus* sp., *Pseudomonas* sp., *Salmonella* sp., *Campylobacter jejuni* and *Yersinia enterocolitica* are known for their abilities to form bioflims on food surfaces (Chmielewski and Frank, 2003).

Among all food borne pathogens *Pseudomonas* sp., are Gram negative bacteria has been listed as a primary target for antimicrobial research according to the Infectious Disease Society of America (IDSA) (Talbot et al., 2006). *Pseudomonas* sp., utilizes the quorum sensing mechanism for the production of virulence factors, which plays a crucial role in pathogenicity (Chugani et al., 2002). The genus of *Pseudomonas* utilizes a wide spectrum of source for their growth (de Oliveira et al., 2015). Among the different food sources *Pseudomonas* sp., are frequently found in stored foods having high water content, low pH (red meat, fish, poultry and dairy products) (Stellato et al., 2017). *Pseudomonas* sp., occurs as post pasteurization contaminant in milk, while in raw milk these organisms may produce many heat stable lipolytic and proteolytic enzymes, which can reduce both the quality and taste of milk (Zhang et al., 2019).

Some species of Pseudomonads known to contaminate the milk products are also known to cause infections associated with *Pseudomonas* sp., (Silby et al., 2011). *P. aeruginosa* is an opportunistic pathogen usually known to infect the airways among patients having cystic fibrosis causing significant morbidity and mortality (Worlitzsch et al., 2006). *P. aeruginosa* is a well-studied pathogen due to its potentiality to cause nosocomical infections, associated with the formation of biofilms and resistance to conventional antibiotics (Mulcahy et al., 2014; Rybtke et al., 2015).

Quorum sensing among *P. aeruginosa* is dependent on the specific group of proteins that binds or recognise specific autoinducer (AI) molecules (Fraile-Ribot et al., 2018). So far four different QS systems have

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