Alanine racemase as target to inhibit the Campylobacter jejuni biofilm formation by L and D-amino acids

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The ability of bacterial pathogens to form biofilm is an important virulence mechanism in relation to its pathogenesis and transmission. Biofilms play a crucial role in survival in unfavourable environmental conditions, act as reservoirs of microbial contamination and antibiotic resistance. For intestinal pathogen Campylobacter jejuni, biofilms are considered to be a contributing factor in transmission through the food chain and currently, there are no known methods for intervention. Here we present an unconventional approach to reducing biofilm formation by C. jejuni by the application of D-amino acids (DAs), and L-amino acids (LAs). We found that DAs not LAs, except L-alanine, reduced biofilm formation by up to 70%. The treatment of C. jejuni cells with DAs changed the biofilm architecture and reduced the appearance of amyloid-like fibrils. In addition, a mixture of DAs enhanced antimicrobial efficacy of D-Cycloserine (DCS) up to 32% as compared with DCS treatment alone. Unexpectedly, D-alanine was able to reverse the inhibitory effect of other DAs as well as DCS. Furthermore, L-alanine and D-tryptophan decreased transcript levels of alanine racemase (alr) and D-alanine-D-alanine ligase (ddIA). Our findings suggest that a combination of DAs could reduce biofilm formation, viability and persistence of C. jejuni.