Relation between tetR and tetA expression in tetracycline resistant Escherichia coli

Background: Tetracyclines are among the most used antibiotics in livestock worldwide. Resistance is widely disseminated in Escherichia coli, where it is generally mediated by tetracycline efflux pumps, such as TetA. Expression of tetracycline efflux pumps is tightly controlled by the repressor TetR, which has been shown to be tetracycline-responsive at sub-MIC tetracycline concentrations. The objective of this study was to investigate the effects of increasing tetracycline concentrations on the growth of TetA-producing E. coli, and to determine how expression of tetA and tetR related to each other in different growth phases in the presence of tetracycline. Results: A tetracycline resistant E. coli strain containing tetA and tetR on the chromosome was constructed and cultured in the presence of increasing concentrations of tetracycline. Expression of tetR and tetA was measured at four time points in different growth phases by quantitative real-time PCR. The TetA-producing E. coli exhibited prolonged lag phase with increasing concentrations of tetracycline, while expression of tetA and tetR increased and decreased, respectively, with increasing tetracycline concentration. The levels of tetA and tetR mRNA varied depending on growth phase, resulting in a gradual decrease of the tetA/tetR ratio from approximately 4 in the lag phase to approximately 2 in the stationary phase. Conclusion: This study shows that the expression of tetR and tetA is tetracycline concentration- and growth phase-dependent, contributing to improved understanding of the relationships between E. coli growth, tetracycline exposure and expression of tetracycline resistance.

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