

Research experience & future research plans

Introduction

In the course my nine and half years of research experience, I have had the privilege of working in different research projects, most of which focused on foodborne contaminants that cause infectious diseases in human. A selected few of my research experiences are briefly described in the following list.

Sporadic case of enterohemorrhagic colitis through hand-to-mouth transmission

A sporadic case of enterohemorrhagic colitis was reported to the Minnesota Department of Health, Minnesota, USA. Isolated culture of the infectious agent from the patient was compared using genetic fingerprinting technique with the environmental isolates obtained from the house of the patient. It was confirmed as the etiological agent responsible for the illness. The study also confirmed source of the pathogen, and its route of transformation from the environment to the patient.

Fingerprinting of *Escherichia coli* isolates naturally occurring in fresh produce

Naturally occurring *E. coli* isolates obtained from farm-fresh fruits and vegetables were fingerprinted, and cluster analysis on their genetic fingerprints was performed to identify any relationship that may exist between these isolates obtained from different agricultural farms. Being a longitudinal study, survival of these *E. coli* strains in farm environment was also examined by repeated detection of the same genetic type along the time scale. This study opened up a very interesting area of future research, in which these *E. coli* strains would be characterized to evaluate their survival or adaptation strategy in the harsh environmental conditions that exist in agricultural farm.

Attachment to surfaces through biofilm production verotoxigenic *E. coli*, as affected by their quorum sensing ability

It has been established that at a high cell density, binding of autoinducers (e.g. AI-2) with cell receptors regulates gene expressions for virulence factors, bioluminescence, biofilm formation, cell-to-cell communication, flagellar synthesis, and motility. Pathogenic *E. coli*, both AI-2-positive and negative strains, were evaluated for biofilm production under various environmental conditions and surface characteristics. Although, this research project is yet to be completed, preliminary data analyses suggested that biofilm formation in the pathogenic *E. coli* strains was not strongly correlated to AI-2 secretion, but is affected by certain environmental conditions and surface characteristics. Further data analyses and derivations are currently being worked out in this research project. In future, I am interested to continue research works in the area of foodborne infections and its remedies at food production, processing, handling, distribution and consumption stages of food chain.

Development and characterization of bioremediation against foodborne etiological agents

All natural environmental niches are habitats of different microbial

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populations. Fresh fruits and vegetables are no exception. Published reports have documented non-detectable levels of foodborne pathogen or very short period of survival of infectious agents in the microenvironment that exists either on the surface or in the internal tissues of fresh fruits and vegetables. Numerous studies have focused on physical (e.g. geometry, surface texture, water activity) and chemical (pH, presence of organic acid and added preservatives) hurdles of this microenvironment that lead to rapid death or lack of growth of foodborne pathogens. In my future research, I would attempt to focus on biological agents naturally occurring in this environmental niche. Fruits and vegetables are well-known for providing natural habitat for lactic acid bacteria, which possess well-established and well-documented antimicrobial characteristics. However, in the proposed research project, I would like to evaluate genotypic characterization of such naturally occurring agents of bioremediation. Once genetic sequence(s) are identified, the target protein(s) will be isolated and characterized on the basis of its molecular weight, and the strains producing the target protein(s) will be evaluated through *in vivo* antibacterial assay.

Survival strategy of *E. coli* O157:H7 in microenvironments that exist in food production areas

Foodborne strains of *E. coli* O157:H7 will be evaluated for virulence genes, particularly those responsible for attachment and survival on food surfaces or in food matrices or in food production environments. Published reports showed variable degrees survival of the pathogen depending upon different environmental niches and conditions prevailing in those niches. In the future research work that I plan to conduct, significance of the virulence genes in *E. coli* O157:H7 strains, particularly the plasmid-mediated ones, in attachment to and survival in food environments will be examined. Such research work may yield diversified avenues exploration considering different physical and chemical conditions associated with a particular environmental niche.

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Conflict of interest

The author declares no conflict of interest.