

# Characterization of antibiotic-resistant enterobacteria from fresh produce in Germany

Gyu-Sung Cho(gyusung.cho@mri.bund.de), Gregor Fiedler, Jan Kabisch

Charles Franz

Department of Microbiology and Biotechnology Max Rubner-Institut Federal Research Institute of Nutrition and Food

## Abstract

Gram-negative Enterobacteriaceae are members of the normal intestinal microbiota of humans and animals, and they are isolated from several other environments, such as waste water, surface water, soil and foods. Some of the Enterobacteriaceae genera, such as *Klebsiella*, *Enterobacter*, *Citrobacter* and *Serratia* are usually harmless commensals, but they can play an important role in food spoilage. Some of the species of these genera also are opportunistic pathogens, which is complicated by the fact that strains may harbor antibiotic resistant genes. Antibiotics are being used for therapeutical purposes in livestock production on a relative large scale and the manure which still contains antibiotic resistant micro-organism from livestock farming have been used as a fertilizer in agriculture. This has been linked to the emergence and spread of multi resistant bacteria from animals, animal-derived foods and vegetables to people (Berg et al., 2014).

In our investigation of antibiotic resistant bacteria from fresh produce in northern Germany, 55 strains were isolated on tetracycline-containing agar medium. Of these, 17 were identified as *Serratia* spp., 14 as *Enterobacter* spp., 10 as *Citrobacter* spp. and 10 as *Klebsiella* spp. based on 16S rRNA gene sequencing. These *S. marcescens*, *E. ludwigii*, *K. pneumoniae* and *C. freundii* species were the most commonly isolated species in each of the respective genera. The results on antibiotic resistances showed that not all isolates from the tetracycline-containing 'selective' media were indeed tetracycline resistant, and the incidence of resistant strains in the different genera varied between 13.3 and 62.5%. The highest incidence of resistance among most strains of all four genera occurred for ampicillin. The genus *Citrobacter* contained the highest incidence of 50 % of streptomycin-resistant strains. The strains in this study were generally not highly resistant to other clinically relevant antibiotics, suggesting that the vegetable isolates pose only a low risk for infection with multiply resistant strains from this source.

**Keywords:** *Enterobacteriaceae*, antibiotic-resistance, tetracycline

## References

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## Biography

Gyu-Sung Cho is a head of laboratory in the Department of Microbiology and Biotechnology of the Max Rubner-Institut, Federal Research Institute of Nutrition and Food in Kiel Germany. He took up a DAAD scholarship and received his Ph.D. under the supervision of Dr. Charles Franz. His current research focused on a metabolism of anaerobic bacteria, whole-genome sequencing, food microbiota with Illumina platform and characterization and identification of antibiotic resistant bacteria.

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