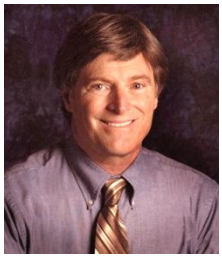
ESBLs in our food supply…

Superbugs…

Tastes Like Chicken?



By Jay Hardy, CLS, SM (NRCM)

Jay Hardy is the founder and president of Hardy Diagnostics. He began his career in microbiology as a Medical Technologist in Santa Barbara, California.

In 1980, he began manufacturing culture media for the local hospitals. Today, Hardy Diagnostics is the third largest culture media manufacturer in the United States.

To ensure rapid and reliable turn around time, Hardy Diagnostics maintains six distribution centers, and produces over 3,000 products used in clinical and industrial microbiology laboratories throughout the world.

A new study from the Netherlands indicates that eating chicken can lead to human infection with the highly drug resistant ESBL strains of gram-negative bacteria, commonly known as the "superbugs."

ESBL (Extended Spectrum Beta-Lactamase) containing strains of bacteria produce enzymes that bring about resistance to antibiotics like penicillin and the cephalosporins. ESBL enzymes are most commonly produced by two bacteria - *E. coli* and *Klebsiella pneumoniae.*

In this study, patients suffering from serious urinary tract or bloodstream infections were evaluated. One in five of these patients were infected with ESBL-bacteria that were genetically identical to the bacteria found in chicken.

The human and chicken isolates were analyzed using an ESBL-specific microarray, sequencing of ESBL genes, PCR-based replicon typing of plasmids, plasmid multi-locus sequence typing (pMLST) and strain genotyping (MLST).

The authors concluded that 35% of the human isolates contained poultry-associated ESBL genes. Of these, 19% were located on plasmids that were genetically indistinguishable from those found in poultry.

In the Dutch poultry industry, the usage of antibiotics is higher than in any other European country – consequently, ESBL prevalence is correspondingly high.

The study also revealed that nearly all chicken (94%) in Dutch supermarkets and at poultry farms are infected with ESBL-bacteria, possibly due to common use of antibiotics in their feed.

The findings suggest that the affected patients obtained the bacteria directly or indirectly from chicken. The research was published in the *Journal of Clinical Microbiology and Infection*.

In the mid-1980s, a new group of enzymes, the extended-spectrum beta-lactamases (ESBLs), were detected (first in Germany in 1983). ESBLs are beta-lactamases that hydrolyze extended-spectrum cephalosporins with an oxyimino side chain. These cephalosporins

include cefotaxime, ceftriaxone, and ceftazidime, as well as the oxyimino-monobactam, aztreonam. Thus, ESBLs confer resistance to these antibiotics and related oxyimino-beta lactams. The ESBLs are frequently plasmid encoded. Plasmids responsible for ESBL production frequently carry genes encoding resistance to other drug classes (for example, aminoglycosides).

Figure 1: ESBLs are *β*-lactamases capable of hydrolyzing penicillins, first-,second-, and third-generation cephalosporins as well as monobactams (such as aztreonam), but not cephamycins or carbapenems. Furthermore, these enzymes are inhibited by *β*-lactamase inhibitors such as clavulanic acid.

Therefore, antibiotic options in the treatment of infections from ESBL-producing organisms are extremely limited. Carbapenems are the treatment of choice for serious infections due to ESBL-producing organisms, yet carbapenem-resistant isolates have recently been reported. To complicate matters, ESBL-producing organisms may appear susceptible to some extended-spectrum cephalosporins. However, treatment with such antibiotics has been associated with high failure rates.

The authors of this study found that, of the retail meat samples, 94% contained ESBL-producing isolates from which 39% belonged to *E. coli* genotypes also present in human samples. These findings are suggestive of transmission of ESBL genes, plasmids and *E. coli* isolates from poultry to humans, most likely through the food chain.

An effective screening method for ESBL can be found in Hardy Diagnostics' new HardyCHROM ESBL culture media.

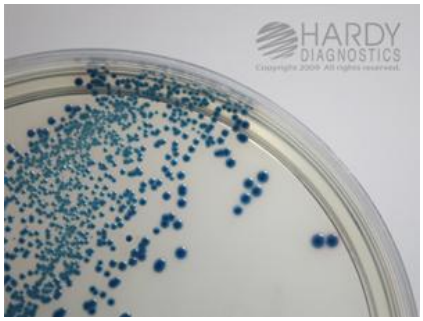


Figure 2: *Klebsiella pneumoniae* (ATCC® 700603) colonies growing on HardyCHROM™ ESBL (Cat. no. G321). Incubated aerobically for 24 hours at 35 deg. C.

This study reveals once again the problems created by tampering with food production in an effort to maximize output. In attempting to solve one problem, we often create another far more serious one.

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