ANTIBIOTICS RESISTANCE RISE IN *Salmonella spp.* AND *Campylobacter spp.*

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INTRODUCTION

Foodborne pathogens are causing a great number of diseases with significant effects on human health and the economy. Different biological etiological agents can cause food poisoning in humans, like bacteria *(Bacillus cereus, Campylobacter jejuni, Clostridium botulinum, Clostridium perfringens*, *Escherichia coli*, *Listeria monocytogenes*, *Salmonella spp.*, *Shigella spp.*, *Staphylococcus aureus, Vibrio spp.* and *Yersinia enterocolitica*), viruses (Hepatitis A and Noroviruses) and parasites (*Cyclospora cayetanensis*, *Toxoplasma gondii,* and *Trichinella spiralis*).[1]
Every year, nearly one in 10 people around the world fall ill after eating contaminated food, leading to over 420 000 deaths.[2]

The two mains bacterial pathogens for the number of cases in the US and Europe are *Salmonella spp*. and *Campylobacter spp.* They account respectively for 1.35 million infections[3] (*Salmonella spp*.) and 1.5 million infections[4] (*Campylobacter spp*.) in the US, and 88.000 (*Salmonella spp*.) and 221.000 infections in Europe[5].

SOURCES OF INFECTIONS

People can get *Salmonella* and *Campylobacter* infection from various sources, including contaminated food or drinking contaminated water.

While *Salmonella* is generally connected to the consumption of raw or contaminated eggs, *Campylobacter* is usually associated with the consumption of unproper cooked poultry meat. Cases of cross-contamination are common. Proper hygiene and cooking are fundamental to avid poisoning.[3,4]

ANTIBIOTICS RESISTANCE RISE IN *SALMONELLA* AND *CAMPYLOBACTER*

Salmonellosis and campylobacteriosis are generally self-limited illnesses and therefore do not require treatment. However, **antimicrobial treatment may be necessary for clinical treatment when patients are immunocompromised or have other co-morbidities.**

In a study published in Emerging Infectious Diseases[6], the researchers estimated a **40% increase** in the annual incidence of **nontyphoidal Salmonella infections** with clinically important resistance in 2015-2016 compared with 2004-2008. When extrapolated to the entire US population, that amounts to **roughly 63,000 more infections a year caused by antibiotic-resistant Salmonella**.

According to the Authors: "Extrapolating to the United States population and accounting for unreported infections, **we estimated a 40% increase** in the annual incidence of infections with clinically important resistance (resistance to ampicillin or ceftriaxone or nonsusceptibility to ciprofloxacin) during 2015–2016 (≈**222,000 infections**) compared with 2004–2008 (≈**159,000 infections**)."

Also: "Changes in the incidence of resistance varied by serotype. Serotypes I 4,[5],12:i:- and Enteritidis were responsible for two-thirds of the increased incidence of clinically important resistance during 2015–2016. **Ciprofloxacin-nonsusceptible infections accounted for more than half of the increase**".

Similarly, also the incidence of antibiotics resistant *Campylobacter* is rising. In an article published in 2017 in *Animal Health Research Reviews*[7], the authors stated that: "before 1992 FQ*-resistant *C. jejuni* was rarely observed in the USA, whereas from 1992 to 2001, FQ-resistant *C. jejuni* of human origin increased **from 1.3 to 40.5%.** A similar rising trend in FQ resistance among Campylobacter isolates was also reported in other countries. For example, ciprofloxacin resistance among Campylobacter species from humans increased from zero before 1991 to 84% in 1995 in Thailand. A recent study from China found that **almost 100% of the *C. jejuni* and *C. coli* isolates from chicken and swine were resistant to FQs.** Additionally, a steady increase in FQ-resistance among Campylobacter isolates has also been observed in many European countries."

From the same article: "Compared with FQ resistance, macrolide resistance is much less prevalent in Campylobacter. However, increased but varied prevalence of macrolide-resistant *C. jejuni* and *C. coli*

* Fluoroquinolones

has been reported in both developed and developing countries". Finally, "Multidrug resistance (MDR) was defined as being resistant to three or more antimicrobial classes, and the most common drugs Campylobacter is resistant to include FQ, macrolides, tetracycline, florfenicol, trimethoprim–sulfamethoxazole A recent study **from Thailand revealed that 100% of *C. jejuni* and 98.9% of *C. coli* isolates from commercial broiler production chains were MDR,** respectively, and most *C. coli* isolates were resistant to FQ, tetracycline, and trimethoprim. In China, 41.9 to 97.6% of retail chicken isolates exhibited MDR to three or more classes of antibiotics."

COPAN PRODUCTS FOR *SALMONELLA* AND *CAMPYLOBACTER* SAMPLE COLLECTION AND *SALMONELLA* ENRICHMENT

FecalSwab™

The combination of FecalSwab™ + FLOQSwabs® represents a unique tool for the collection and transport of fecal sample. If you are investigating gastrointestinal tract AMR pathogens, FecalSwab™ is the product to use. Compatible with both stool and rectal swabs, FecalSwab™ showed better preserving properties at different storage conditions than traditional media and dry containers. FecalSwab™ is validated for bacterial culture and fully compatible with molecular-based assays. FecalSwab™ allows to test solid or semi-solid fecal specimens with automatic specimen processors in space-saving, instrument-ready tubes, and if you are a WASP® owner, you can process FecalSwab™ samples with it.

Copan FecalSwab™ incorporates a modified Cary-Blair medium (2mL), a nonnutritive transport and preservation medium.

Copan FecalSwab™ preserves collected specimens for 48h at room temperature or 72h at refrigerated temperature (2-8°C).

In the case of *C. difficile* culture investigation, Copan FecalSwab™ preserves collected specimens up to 24h at room temperature and 48h at refrigerated temperature (2-8°C).

According to the vast scientific literature, FecalSwab™ has been successfully used for:

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- Long-term preservation of samples at -80°C for molecular analysis

SELENITE Broth

Copan Selenite Broth is a selective enrichment broth for clinical samples used for the culturing and the subsequent isolation of enteric pathogens, including *Salmonella spp*. and *Shigella spp*.

GN Broth

GN broth is an enrichment and selective medium for enteric Gram-negative bacilli that especially promotes the recovery of *Salmonellae* spp. and *Shigella* spp. The increased amount of mannitol over dextrose promotes the growth of salmonella and shigella while slowing the growth of non-fermenting mannitol species such as *Proteus* spp. or *Pseudomonas* spp.

CONCLUSIONS

The antibiotic resistance rise in *Salmonella spp*. and *Campylobacter spp.* is becoming an issue of concern, especially for fragile and immunocompromised individuals. It could also be worth extending, especially in these specific populations, the AMR testing to assure the best treatment.

The lack of validated molecular assays for the detection of resistance genes in *Salmonella spp*. and *Campylobacter spp.* makes culture and subsequent antimicrobial susceptibility testing fundamental for patient management. Thus, the specimen collection must be managed carefully to assure reliable and quality results.

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