# Shiga toxin-producing escherichia coli in human, cattle, and foods. strategies fo...

Shiga toxin-producing *E. coli* (STEC) also known as " verocytotoxin-producing *E. coli* ," refers to *E. coli* pathotypes capable of producing Shiga toxin type 1 (Stx1), type 2 (Stx2), or both, encoded by *stx1* and stx2 genes, respectively ( Paton and Paton, 1998 ). The genes encoding Stx are carried by temperate bacteriophages insert into bacterial genoma so that Stx production is linked to the induction of the phage lytic cycle ( O'Loughlin and Robins-Browne, 2001 ). STx2 is the toxin type most related to hemolytic uremic syndrome (HUS) and comprise several subtypes which differ in their citotoxicity ( Persson et al., 2007 ). Stx2g is one of those subtypes that were studied by Granobles Velandia et al. (2012) who found several differences among *stx* 2g-positive strains. The strains with the highest cytotoxic titer showed higher levels of *stx* 2-phages and toxin production by EIA, while the opposite occured for strains that previously showed low cytotoxic titers, confirming that in *stx* 2g-positive strains Stx production is phage regulated.

Other typical virulence factor is intimin, which is required for intimate bacterial adhesion to epithelial cells inducing a characteristic lesion defined as " attaching and effacing" (A/E). It is encoded by *eae* gene that presents heterogeneity in their 3′ end and involved in binding to the enterocytes ( Guth et al., 2010 ). Additional virulence-associated markers are a plasmid-encoded enterohemolysin and, in strains lacking *eae* , an autoagglutinating adhesin (Saa) which could be involved in the adhesion of strains ( Paton et al., 2001 ). Strains laking *eae* are named as LEE-negative STEC. Steyert et al. (2012) demonstrate that the overall genome content, phage location, and combination of potential virulence factors are variable in this strains group.

STEC are zoonotic pathogens that cause the vascular endothelial damage observed in patients with hemorrhagic colitis (HC) and HUS. HUS is characterized by acute renal failure, thrombocytopenia, and microangiopathic hemolytic anemia and is a potentially fatal cause of acute renal failure in children ( Etcheverría and Padola, 2013 ). HUS there has not treatment and use of antimicrobial agents is associated with an increased risk of severe sequelae such as HUS. Referred to this, Rahal et al. (2012) dicussed novel modalities and regimen of antimicrobial agent administration in an attempt at decreasing their association with aggravating infection outcomes.

Cattle are the main reservoir of STEC and shed the bacteria through their feces spreading these pathogens among cattle herds and the environment. Nguyen and Sperandio (2012) review about the factors and mechanism utilized by O157: H7 STEC for its survival through the acidic environment of the distal stomach and for its colonization in the recto-anal junction. Fernández et al. (2013) characterized two most prevalent serotypes in argentinian cattle demonstrating the potential pathogenic of this strains. Blanco Crivelli et al. (2012) informed that synanthropic species could play role in the transmissibility of the agent thus being a risk to the susceptible population.

Food, water, milk, and person to person contact commonly participate in transmission, although there is a growing concern about some sporadic cases and outbreaks attributable to direct contact with the animal environment ( Duffy, 2003 ). Brusa et al. (2013) report the prevalence of

STEC O157 and non-O157 in commercial ground beef and ambient samples, including meat table, knife, meat mincing machine, and manipulator hands suggesting cross-contamination between meat and the environment. One method for reducing STEC in food could be the use of phages. About this, Tomat et al. (2013) inform the isolation of phages highly specific for virotypes of *E. coli* that could be useful in reducing STEC in meat products.

In order to diagnose STEC (O157 and non-O157) several methods have been implemented in the last years ( Padola, 2014 ). Botkin et al. (2012) investigate a multiplex PCR to differentiate EPEC, STEC, and EHEC strains from other pathogenic *E. coli* , Fratamico and Bagi (2012) use a GeneDisc system to evaluate a new PCR-real time technology based on simultaneous detection of multiple targets, Quiñones et al. (2012) evaluate a DNA microarray targeted 12 virulence factors implicated in produce human disease while Parma et al. (2012) developed a sandwich ELISA for determination of Stx using anti-Stx2 B subunit antibodies showing that could be used in routine diagnosis as a rapid, specific and economic method for detection of STEC. The implementation of Multiple-locus variable-number tandem repeat analysis (MLVA) as subtyping method is review by Bustamante et al. (2012) who have adapted this method for analysis of non-O157 STEC performing an efficient O157: H7 and non-O157 STEC subtyping.

## Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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