



FICHA TÉCNICA DE PROYECTOS

Nombre del proyecto:	AGISAR: Prevalence and Antimicrobial resistance of <i>Campylobacter</i> , <i>Salmonella</i> and <i>E. coli</i> ESBL in poultry farms, poultry meat at retail and human gastroenteritis cases in Ecuador. ARES: Prevalencia y resistencia a los antibióticos en cepas de <i>Salmonella</i> spp., <i>Campylobacter</i> spp. y <i>Escherichia coli</i> ESBL, en carcasas de pollos en percha en la ciudad de Quito.
Investigador (es) principal (es)	Christian Vinueza
Investigador (es) asociado (s)	Jorge Reyes, Eduardo Villacis, Fernando Villavicencio, Carolina Satán, Katherine Jaramillo, Sofía de Janon, José Luis Medina
Organismo Financiador	Organización Mundial de la Salud (OMS). Grupo AGISAR. Académie de recherche et d'enseignement supérieur (ARES)
Monto de Financiamiento:	70.000 USD AGISAR-OMS 15.000 USD ARES
Fecha de Inicio:	ARES: Marzo de 2017 AGISAR: Noviembre 2017
Fecha de Finalización:	Noviembre de 2019
Instituciones participantes:	<ul style="list-style-type: none">• UNIETAR. Facultad de Medicina Veterinaria y Zootecnia. Universidad Central del Ecuador.• Instituto Nacional de Investigación en Salud Pública – Dr. Leopoldo Izquieta Pérez (INSPI – LIP). Ministerio de Salud Pública del Ecuador (MSP).
Códigos:	Dirección de Investigación UCE: 21E-2018 Ministerio de Salud Pública del Ecuador: MSPCURI000234-5 ARES: 082-ARES-UG
Objetivos generales:	Identificar la prevalencia y resistencia de <i>Salmonella</i> spp., <i>Campylobacter</i> spp. y <i>E. coli</i> BLEE en granjas avícolas, carcasas de pollo de venta al público y en muestras humanas de la ciudad de Quito.
Resumen Ejecutivo:	<i>Salmonella</i> <i>Salmonella enterica</i> is one of the most important foodborne pathogens around the world. In the last years, <i>S. Infantis</i> has become an important emerging pathogen in many countries, often, as multidrug resistant clones. To understand the importance of <i>Salmonella enterica</i> in broiler industry in Ecuador, we performed a study with a One Health approach based on phenotypic and WGS data of isolates from poultry farms, chicken carcasses and humans. We showed a high prevalence of <i>S. enterica</i> in poultry farms (41.4%) and chicken carcasses (55.5%), but a low prevalence (1.98%) in human samples. <i>S. Infantis</i> was shown to be the most prevalent serovar with a 98.2%, 97.8% and 57.1% in farms, foods and humans, respectively, presenting multidrug resistant patterns. All <i>S. Infantis</i> isolates belonged to ST32. For the first time, a pESI-related megaplasmid was identified in Ecuadorian samples. This plasmid contains genes conferring antimicrobial

resistance, virulence, and environmental stress tolerance. Genomic analysis shows a low divergence of *S. Infantis* strains in the three components analyzed. Results from this study provide important information about the molecular epidemiology of *Salmonella* in Ecuador.

This work constitutes an important contribution to understand microbial resistance and epidemiology of *Salmonella enterica* serovar *Infantis* in Ecuador with a One Health approach. We have analyzed by phenotypic analysis and WGS data 137 *S. Infantis* isolates from poultry farms, chicken carcasses and human stool samples. Our findings show a high prevalence of this emerging foodborne pathogen, especially in farms and foods. A clear association between multidrug resistance and the presence of pESI-like megaplasmid in *S. Infantis* ST32 was identified. We also found low divergence of *S. Infantis* isolates in the three components (farms, foods and human cases) studied. To our knowledge this is the first description in Ecuador to demonstrate with whole genomes the transmission of *Salmonella enterica* through the food chain.

Escherichia coli

Antimicrobial resistance (AR) is a major health threat for the 21st century. However, over than 50% of antibiotics are used for meat production even infection treatment. In Ecuador, antibiotics have been used by the poultry industry for decades, and the consequence of this practice are the isolation of multi-drug resistant (MDR) bacteria from the poultry products with the consequent risk for the community. This study evaluated the prevalence of resistance to extended-spectrum β -lactamases (ESBL), *bla*_{CMY} and *mcr* (1 to 5) genes in third generation cephalosporin resistant *Escherichia coli* (3GC-R *E. coli*) isolated from broiler farms (animal component), broiler carcasses (food component), and human enteritis (human component) in Quito-Ecuador. Samples were collected weekly from November 2017 to November 2018. For animal, food and human components were analyzed 133, 335 and 302 samples, respectively. AR profiles of the Isolates were analyzed by automated microdilution systems and resistance genes by PCR and sequencing. 526/770 samples were positive for 3GC-R *E. coli*: 122/133 (91.7%), 258/335 (77%) and 146/302 (48.3%) in the animal, food and human components, respectively. Most of the isolates (472/526, 89.7%) were MDR. The ESBL genes *bla*_{CTX-M-55}, *bla*_{CTX-M-3}, *bla*_{CTX-M-15}, *bla*_{CTX-M-65}, *bla*_{CTX-M-27} and *bla*_{CTX-M-14} were the most prevalent. Only the *bla*_{CMY-2} was detected. The *mcr-1* gene was found in 20/122 (16.4%), 26/258 (10.1%) and 3/146 (2.1%) of isolates from animal, food, and human components, respectively. The implication of poultry products in the prevalence of 3GC-R and colistin resistance *E. coli* must be considered in the AR monitoring national plans.

Poultry industry is an increasingly important segment of food production and contributor to AR. However, studies of third generation cephalosporin resistant *E. coli* (3GC-R *E. coli*) in poultry production remain scarce in the Andean region of South America. In the case of Ecuador only our previous study has evaluated the prevalence of *mcr* genes in 3GC-R *E. coli* from poultry, this issue has been no evaluated with a one health approach in this region. Therefore, we evaluate the prevalence, antimicrobial resistance patterns and characterized the most relevant resistance genes in Extended Spectrum β -lactamases (ESBL) and AmpC *E. coli*, including *bla*_{CTX-M}, *bla*_{CMY} and *mcr-1* to 5 genes, from broiler farms (animal component), broiler carcasses (food component), and human enteritis (human

	<p>component) in Quito-Ecuador for the first time. We identified high prevalence of multidrug resistant <i>E. coli</i>, a variety of AR patterns, and ESBL/AmpC genes and <i>mcr-1</i> genes with significative differences between the components. Our results show that large poultry production systems are an important reservoir for antimicrobial resistance in Ecuador, Additionally, these data are useful for the development of national and regional plans of antimicrobial resistance surveillance.</p>
<p>Productos:</p>	<p>Artículos científicos</p> <ul style="list-style-type: none"> • Mejía, L., Medina, J. L., Bayas, R., Salazar, C. S., Villavicencio, F., Zapata, S., Matheu, J., Wagenaar, J., González-Candelas, F., Vinueza-Burgos, C. (2020). Genomic Epidemiology of <i>Salmonella</i> Infantis in Ecuador: From Poultry Farms to Human Infections. <i>Frontiers in Veterinary Science</i>, 7(September). DOI: 10.3389/fvets.2020.547891 • Ortega-Paredes D, de Janon S, Villavicencio F, Villacís J. E., Wagenaar J. A., Matheu J, Bravo-Vallejo C, Vinueza-Burgos C. (2020). Broiler farms and carcasses are an important reservoir of multi-drug resistant <i>Escherichia coli</i> in Ecuador. <i>Frontiers in Veterinary Science</i>, 25(November). DOI: 10.3389/fvets.2020.547843 <p>Tesis</p> <ul style="list-style-type: none"> • Gómez C. (2018). Cuantificación y caracterización genética de cepas de <i>Campylobacter</i> spp. aisladas de muestras de carcasas de pollos en percha en el cantón Quito (Tesis de maestría). • Moral M. (2018). Cuantificación de cepas de <i>Escherichia coli</i> y <i>Escherichia coli</i> BLEE aisladas de carcasas de pollo en percha en el cantón Quito (Tesis de maestría). • Mantilla J. (2019). Tipificación fenotípica y molecular de resistencias a los antimicrobianos en <i>Escherichia coli</i> BLEE/AmpC aislados de ciegos y carcasas de pollos broiler. • Japón M. (2019). Aislamiento y Serotipificación de <i>Salmonella</i> en carcasas de pollo en percha en la ciudad de Quito. • Damián P. (2019). Identificación de factores de riesgo y caracterización de la resistencia a los antimicrobianos en <i>Salmonella</i> spp. en granjas y carcasas de pollos en el área de influencia del cantón Quito (Tesis de maestría). • Pillalaza J. (2018). Aislamiento e identificación de Coliformes y <i>Escherichia coli</i> BLEE en coches de compras de supermercados en el cantón Quito. • Heredia A. (2018). Aislamiento y caracterización de resistencia a los antibióticos de <i>Salmonella</i> en coches de supermercados ubicados en la ciudad de Quito, provincia de Pichincha. <p>Pósters</p> <ul style="list-style-type: none"> • Mejía, L., Medina-Santana, J., Bayas-Rea, R., Satán-Salazar, C., Villavicencio, F., Zapata, S., Matheu, J., Wagenaar, J., González-Candelas, F., Vinueza-Burgos, C. (2022). Genomic Epidemiology of <i>Salmonella</i> Infantis in Ecuador: From Poultry Farms to Human Infections. 30S Internacional Symposium Salmonella & Salmonellosis. Saint-Malò - Francia.