

**TITLE:** ANTIMICROBIAL RESISTANCE PATTERNS AND DETECTION OF *BLA*<sub>TEM</sub>, *BLA*<sub>SHV</sub>, *BLA*<sub>CTX-M</sub> AND *BLA*<sub>GES</sub> GENES IN NOSOCOMIAL ESBL-PRODUCING *ESCHERICHIA COLI* AND *KLEBSIELLA PNEUMONIAE* STRAINS ISOLATED FROM A TERTIARY TEACHING HOSPITAL IN CEARÁ, BRAZIL

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## ABSTRACT

*Escherichia coli* and *Klebsiella pneumoniae* are Gram-negative bacilli account for a significant portion of infections in hospitals, especially due to increased production of Extended-spectrum  $\beta$ -lactamases (ESBL). This study aimed to analyze the antimicrobial resistance patterns of *E. coli* and *K. pneumoniae* strains isolated from nosocomial infections in a tertiary teaching hospital in Sobral/CE, Brazil, from March 2015 to March 2016, and to detect *bla*<sub>TEM</sub>, *bla*<sub>SHV</sub>, *bla*<sub>CTX-M</sub>, *bla*<sub>KPC</sub>, *bla*<sub>VIM</sub> and *bla*<sub>GES</sub> genes in the isolates that exhibited ESBL phenotype. A total of 245 (132 *E. coli* and 113 *K. pneumoniae*) isolates were analyzed. Of these, 145 (59.1%) had ESBL phenotype and 44 were characterized genetically by presence of *bla*<sub>TEM</sub>, *bla*<sub>SHV</sub>, *bla*<sub>CTX-M</sub>, *bla*<sub>KPC</sub>, *bla*<sub>VIM</sub> and *bla*<sub>GES</sub> genes. The minimum inhibitory concentrations (MICs), resistance patterns, and phenotypic detection of ESBL production were determined using the Vitek<sup>®</sup>2 compact automated system. Polymerase chain reaction (PCR) amplification was used to detect the presence of gene encoding GES enzyme and other Extended-spectrum  $\beta$ -lactamases. The rates of *E. coli* and *K. pneumoniae* ESBL producers were 49.2% and 70.8%, respectively. Our data revealed that all ESBL-producing *E. coli* strains were resistant to ceftriaxone and sensitive to meropenem. On the other hand, all *K. pneumoniae* ESBL producers were resistant to ceftriaxone and ceftazidime, and sensitive to colistin. Of the genetically characterized isolates, the *bla*<sub>CTX-M</sub> gene was detected in 31.8%, *bla*<sub>TEM</sub> and *bla*<sub>SHV</sub> genes were detected both in 6.8%, while only one *K. pneumoniae* strain carried *bla*<sub>GES</sub> and *bla*<sub>CTX-M</sub> genes concomitantly. The *bla*<sub>KPC</sub> and *bla*<sub>VIM</sub> genes were not detected. The findings demonstrated high levels of resistance to beta-lactam antibiotics, as well as increasing linear trend for ESBL production by the studied specimens, highlighting the great potential for worldwide spread of resistance genes between Gram-negative bacilli.

**Keywords:** *bla* genes; ESBL; *Escherichia coli*; *Klebsiella pneumoniae*; Teaching hospital.

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