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Extended-spectrum beta-lactamase-producing Enterobacteriaceae in conventional and organic vegetables sold in Brazil

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Infections caused by extended-spectrum beta-lactamase (ESBL)-producing Enterobacteriaceae strains, known for their resistance to various antibiotics (ATBs), represent one of the main public health issues of the 21st century and one of the main threats to global health. To assess the occurrence of ESBL-producing Enterobacteriaceae strains in samples of conventional (CON) and organic (ORG) vegetables sold in Brazil. A total of 60 vegetable samples were purchased from supermarkets in Piracicaba, SP, Brazil. These included lettuce (10 CON and 10 ORG), collard greens (10 CON and 10 ORG), and green peppers (10 CON and 10 ORG), which were obtained in November/2023, a month with a recorded average temperature of 30 °C and 132 mm of rainfall. Portions (25 g) of each sample were enriched in MacConkey broth (37 °C at 24 h) and then inoculated by streaking them on MacConkey agar supplemented with ceftriaxone (2 µg/mL), followed by incubation at 37 °C for 24 h. A total of 180 colonies (three per sample) grown on the plates were selected and purified on Nutrient Agar. For the resistance tests, the strains were grown in Tryptone Soy broth at 37 °C for 24 h, adjusted to a concentration of 10 6 CFU/mL using the McFarland scale, and inoculated onto plates containing Mueller Hinton agar using a swab, followed by drying for 30 min. The following ATBs discs were tested: Ceftiufur, Ceftriaxone, Cefuroxime, Sulbactam, and Amoxicillin + Clavulanate, followed by incubation at 37 °C for 24 h. Strains that showed ESBL characteristics (ghost zones) were also tested for resistance to the ATBs: Chlorophenicol, Florofenicol, Ciprofloxacin, Ofloxacin, Nalidixic Acid, Levofloxacin, Ertapenem, Moxifloxacin, Tetracycline, Enrofloxacin, Gentamicin, Cotrimoxazole. From the 180 isolates, 64 (35.6%) showed characteristic ESBL halos in the first screening, with the majority (40; 62.5%) coming from organic vegetables: lettuce (11; 27.5%), collard greens (13; 32.5%) and green peppers (16; 40%). Furthermore, all the isolates showed resistance to at least three ATBs, with the majority being resistant to Ceftriaxone (81%), Moxifloxacin (81%), and Cefuroxime (80%). These data are alarming since most of the isolates characteristic of ESBL come from organic samples, mainly green peppers. ESBL are known to possibly related to the use of ATBs and pesticides, which are not allowed in this type of production system. Although potentially ESBL-producing Enterobacteriaceae strains have been identified in samples from both production systems, the data obtained in the present study suggests a slightly higher prevalence in organic samples. These findings, coupled with the resistance of all isolated strains to various antibiotics, highlight the need for control measures in the production of these vegetables to promote food safety and consumer health.

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