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Prevalence, Risk Factors and Transmission Dynamics of ESBL Producing Enterobacteriaceae: A National Survey of Cattle Farms in Israel, 2013

Objectives: Our objectives were to study the prevalence, risk factors for carriage and transmission dynamics of ESBLPE in a national survey of Israeli cattle.

Methods: This was a point-prevalence study conducted from July to October 2013 in Israel. Stool samples were collected from cows of all breed types. The following data were collected: age, animal well-being scores, infrastructure characteristics and veterinary treatment. Stool was inoculated onto CHROMAgar ESBL™ plates. Molecular typing was done by REP-PCR and presence of *bla*$_{ESBL}$ genes was determined by PCR. Analyses were done at the section level; in most cases, 10 cows were sampled per section. Bivariate and multivariate analyses were conducted using mixed-effects Poisson regression; results were expressed as rate ratios (RR).

Results: The study included 1226 cows in 123 sections in 40 farms. ESBLPE were identified in 291 samples (23.7%): 287 *E. coli* and 4 *K. pneumoniae*. The number of ESBLPE-positive cows was lowest in sections containing the oldest cows (>25 months) (mean=0.9, reference group) and highest in the youngest cows (<4 months) (mean=5.3, RR=6.53) ($p<0.001$). Infrastructure variables that were significant risk factors for ESBLPE carriage included crowding, lack of manure cleaning and lack of a cooling system ($p<0.001$ for each). Crowding and lack of manure cleaning were more common in sections containing the youngest animals. Antimicrobial prophylaxis was given almost exclusively to the youngest cows and was associated with a high number of ESBLPE carriers (a mean of 5.2 vs.1.3 in sections with and without prophylaxis, respectively; RR=0.23 for non-treated, $p<0.001$). The 287 *E. coli* isolates were typed into 106 REP-PCR types, harboring mostly *bla*$_{CTX-M-1}$ (n=233, 80%) or *bla*$_{CTX-M-9}$ group (n=28, 9.6%) genes. The six farms with ≥15 isolates of ESBLPE had 4-7 different REP-PCR types identified at each farm with one dominant type present in up to half of the isolates. A diverse population of types was present in the isolates retrieved from suckling calves, which were usually present in the other sections.
Fourteen REP-PCR types were identified in more than 1 farm, with only 6 of the farms adjacent to each other.

Conclusions: The combined epidemiological and molecular data suggests that ESBLPE carriage is acquired mainly in suckling calves, where the use of antimicrobial prophylaxis is common and gradually decline in older cows.