

Prevalence of multidrug resistance in *Escherichia coli* in the immediate calves' environment in Swiss dairy farms

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Background

In dairy farms, calves are the animal group that carries the fecal flora with the highest prevalence of antimicrobial resistance (AMR). Calves' age and antimicrobial exposure are major factors affecting AMR prevalence. The calves' housing environment is suspected to be a reservoir of resistant bacteria, acting as a source of colonization of the calves' gut and maintenance of AMR in farms.

Aims

- To describe the prevalence of AMR and multidrug resistance (MDR) in *Escherichia coli* isolated from preweaned calves' housing environment in Swiss dairy farms
- To explore factors associated with AMR and MDR

Methods

Two environmental swabs were taken from the walls and/or railings of the pens or hutches housing 30 to 60-day-old calves in 60 farms. The swabs were incubated in Mueller-Hinton broth at 37°C overnight, then 10 µl of the broth was used to inoculate *E. coli* selective media (BROLAC). Two colonies were selected from each culture (4 per farm, 240 isolates in total), identified by Maldi Tof, and tested for antibiotic susceptibility against a panel of 15 antibiotics by broth microdilution (EUVSEC3 Sensititre®, Thermo Fisher Scientific). Minimum inhibitory concentrations were interpreted based on EUCAST threshold values, except for sulfamethoxazole ($R \geq 512 \mu\text{g/ml}$). Multidrug resistance was defined as resistance to at least three antimicrobial drug classes. Farm characteristics and management practices were recorded by use of a questionnaire.

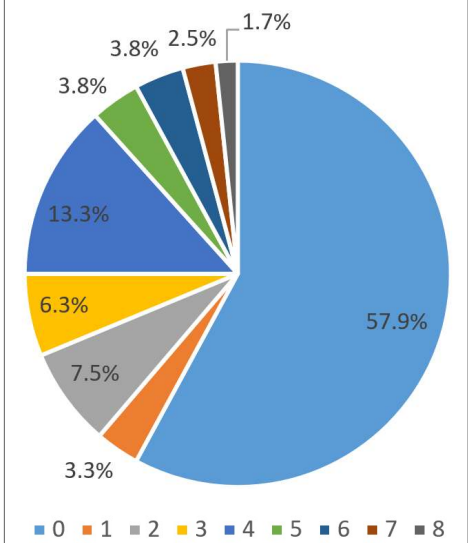


Figure 1. Distribution of isolates according to the number of antimicrobial classes to which they exhibited resistance

Results

Among the 240 isolates, 57.9% were susceptible to all tested antibiotics (Figure 1), whereas 31.3% of all isolates exhibited MDR. The most common resistances were to tetracycline (35.4%), ampicillin (29.2%), trimethoprim (21.7%), and chloramphenicol (19.2%). Among the resistant isolates, AMR against 4 different antimicrobial classes was the most common observation, with the most prevalent pattern (15/101, 14.9%) being AMR to ampicillin, tetracycline, chloramphenicol, and sulfamethoxazole.

At the farm level, at least one out of the four isolates exhibited AMR and MDR in 67% (40/60) and 50% (30/60) of the farms, respectively.

Farm factors associated with the likelihood of an isolate being resistant to at least one antimicrobial drug included the presence of other livestock on the farm (OR 3.78, $P = 0.03$), and a farmer-reported incidence of calf pneumonia > 10% (OR 8.44, $P = 0.002$). The likelihood of an isolate being multiresistant was associated with an incidence of calf pneumonia > 10% (OR 5.33, $P = 0.04$), and the introduction of new animals in the herd in the previous year (OR 6.53, $P = 0.03$). Conversely, the likelihood of an isolate being susceptible to all tested antibiotics was associated with the personnel wearing farm-specific clothes and boots (OR 4.29, $P = 0.02$).

Conclusions

Antimicrobial resistance is a common finding in calves' housing environment in Swiss dairy farms, with MDR isolates found in half of the participating farms. Factors associated with AMR or MDR reflected either disease incidence (presumably associated with increased antimicrobial use) or biosecurity practices.

Further investigation is needed on AMR in calves' environment and its association with

- farm-level antimicrobial use and management practices;
- the colonization by and carriage of resistant *E. coli* in young dairy calves.

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