



# Antimicrobial resistance and effects of management practices, animal transport and barn climate on animal health and antimicrobial use in Swiss veal calf operations – a prospective study

Petra Schnyder<sup>1</sup>, Lutz Schönecker<sup>1</sup>, Gudrun Overesch<sup>2</sup>, Gertraud Schüpbach-Regula<sup>3</sup>, Mireille Meylan<sup>1</sup>

<sup>1</sup>Clinic for Ruminants, University of Bern, CH-3012, Bern, <sup>2</sup>Institute of Veterinary Bacteriology, University of Bern, CH-3012, Bern, <sup>3</sup>Veterinary Public Health Institute, University of Bern, CH-3097, Liebefeld

## Key words

Calf fattening, treatment incidence, antimicrobial resistance, commingling, mortality, risk factors, ammonia

## Aim of the study

To assess the impact of transport, housing, management factors and barn climate on calf health and antimicrobial treatment incidence.

To investigate the prevalence of bacterial pathogens associated with bovine respiratory disease (BRD) in the upper respiratory tract of veal calves and to detect their resistance patterns as well as those of fecal *Escherichia (E.) coli*, serving as indicator organism, in relation with treatment incidence.

## Material and methods

Forty-three farms, of which 34 purchased calves for fattening, were monitored during one year and visited six times during this period. Detailed questionnaires were filled out with the farmers and climate variables were measured in the calf pens. For every purchasing farm, one calf transport was accompanied by the study team, the other transports were documented by the farmers. Risk factors for mortality >3%, increased antimicrobial use and decreased average daily weight gain (ADG) were evaluated in univariable and multivariable logistic models. BRD-associated pathogens were obtained from deep nasopharyngeal swabs, *E. coli* from rectal swabs. Susceptibility testing was performed for *Pasteurella (P.) multocida*, *Mannheimia (M.) haemolytica* and *E. coli* as broth microdilution to determine the minimal inhibitory concentration. Results were interpreted using clinical breakpoints (*Pasteurellaceae*) and epidemiological cut-off values (*E. coli*).

## Results and significance

A total of 4014 calves were fattened in the participating farms during the project.

The overall mortality rate during the observation period was 5.1%. A smaller number of fattened calves per year and a good hygiene of the automatic feeder were significantly associated with mortality >3% in the multivariable model. These unexpected findings are most likely related to the higher impact of a single dead calf on mortality rate in smaller herds and to the fact that farmers suffering from higher calf losses are more likely to pay attention to good hygiene. A higher variation of temperature over 72 hours of continuous measurements was associated with mortality >3% in the univariable model.

The overall mean treatment incidence (TI<sub>UDD</sub>) was 11.8 ± 12.3 daily doses per calf and year (7.0 ± 7.5 in small farms, defined as farms fattening less than 100 animals per year, and 25.9 ± 12.8 in large farms, defined as farms with more than 100 fattened calves per year). The main indication for antimicrobial treatment was BRD (81.1%). No quarantine upon arrival, access to an outside pen, higher numbers of calves per drinking nipple, mechanical ventilation in the stable, vaccination against BRD and a maximum ammonia value >10 ppm in the calf pens were significantly associated with increased TI<sub>UDD</sub> in the multivariable analysis. Passage through markets and higher numbers of birth farms per 10 purchased calves were associated with increased treatment incidence in the univariable model.

The overall mean ADG of the calves included in the study was  $1.40 \pm 0.16$  kg. Calf purchase was a risk factor for decreased ADG in the multivariable model.

A total of 2508 deep nasopharyngeal and 2260 fecal swabs were collected from a representative sample of the population under study (not from clinically sick calves) during herd visits. Prevalence of *Pasteurellaceae* in the upper respiratory tract was 58%, including *P. multocida*, *M. haemolytica*, Taxon 39 and *Histophilus somni*. *Mycoplasma (M.)* species were detected in 86% of the nasopharyngeal swabs, with the cattle pathogen species *M. bovis* and *M. dispar* being prevalent in 32% of the cases. Animals positive for *Pasteurellaceae* or *Mycoplasma* were significantly older than negative ones.

A total of 1162 *P. multocida* and 346 *M. haemolytica* isolates were tested for antimicrobial susceptibility. Depending on availability and suitability of interpretive criteria, the spectrum of evaluable antimicrobial agents varied for the different bacterial species. Following the terminology used in the Swiss Antibiotic Resistance Report 2016, resistance rates of *P. multocida* were extremely high for oxytetracycline, very high for spectinomycin and high for ampicillin, penicillin, chlortetracycline, tilmicosin and tulathromycin. A low resistance rate was observed for ceftiofur, very low resistance rates for enrofloxacin and florfenicol. Regarding *M. haemolytica*, resistance was high to penicillin and tetracyclines and very low to enrofloxacin and tilmicosin. None of the tested *M. haemolytica* isolates were resistant to ceftiofur, florfenicol and thulathromycin in this study.

Epidemiological cut-off values divided the 2138 tested *E. coli* into wildtype- and non-wildtype-populations. Percentages of non-wildtype *E. coli* were very high for ampicillin as well as chlor- and oxytetracycline, high for neomycin and spectinomycin, moderate for enrofloxacin and gentamicin, and low for ceftiofur. All *E. coli* were classed as wildtype isolates for florfenicol in this study.

Multidrug resistance defined as resistance to at least one agent in three or more antimicrobial classes was observed in 31% *P. multocida*, one *M. haemolytica*-isolate and 39% fecal *E. coli*.

These results should be taken into consideration when designing recommendations to improve veal calf health. Appropriate changes should in consequence lead to reduced need for antimicrobial drug use and thus minimize the impact of the veal fattening sector on the selection of resistant bacteria. Isolates resistant to critically important antimicrobial drugs were found in BRD-associated bacteria as well as in *E. coli*, which confirms that these drugs should be used restrictively, i.e. in principle only if sensitivity test results indicate resistance to all alternative non-critical antimicrobial drugs.

### **Publications, posters and presentations**

Schneiter, K. (2017) Beschreibung der Transportbedingungen und der Herkunft der Kälber in Schweizer Kälbermastbetrieben. Masterarbeit an der Wiederkäuerklinik, Vetsuisse Fakultät, Universität Bern.

Perroud, S. (2017) Stallklima in Schweizer Kälbermastbetrieben – Vertiefte Analyse von Stallklimamessdaten im Rahmen des Forschungsprojektes “Auswirkungen von Managementfaktoren auf die Tiergesundheit in Schweizer Mastkälberbetrieben”. Masterarbeit an der Wiederkäuerklinik, Vetsuisse Fakultät, Universität Bern.

Schnyder, P.; Schönecker, L.; Schüpbach-Regula, G.; Meylan, M. Effects of management practices, animal transport and barn climate on animal health and antimicrobial use in Swiss veal calf operations. *In preparation*

Schnyder, P.; Schönecker, L.; Schüpbach-Regula, G.; Meylan, M. Stallklima in Mastkälberbetrieben: Interpretation von Messdaten und Zusammenhänge mit der Kälbergesundheit. *In preparation*

Schönecker, L.; Schnyder, P.; Overesch, G.; Schüpbach-Regula, G.; Meylan, M. Treatment incidence and antimicrobial resistance on veal farms – is there an association for respiratory pathogens and fecal indicator *E. coli*? *In preparation*

Schönecker, L.; Schnyder, P.; Overesch, G.; Schüpbach-Regula, G.; Meylan, M. Association between individual antimicrobial treatments and resistance rates in respiratory pathogens and *E. coli* in veal calves. *In preparation*

Schönecker, L. (2018) Oral presentation: Mykoplasmen- und Pasteurellenprävalenz in Pharynxtpuffern von Schweizer Mastkälbern und deren Resistenzraten, 15. Oberschleissheimer Wiederkäuertagung, Oberschleissheim, 15.03.2018.

Schönecker, L. (2018) Oral presentation: Respiratorische Pathogene und Resistenzraten in Schweizer Kälbermastbetrieben, 6. Schweizerische Tierärztetage, Basel, 26.04.2018.

### **Project 1.16.10**

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